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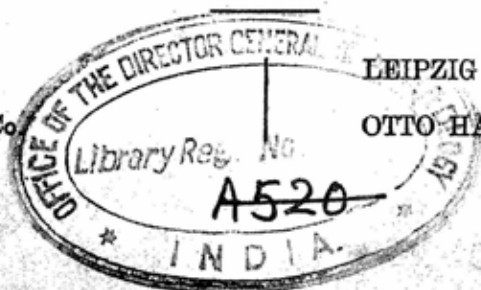
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# THE SIAM SOCIETY.

(FOUNDED 1904.)

For the Investigation and Encouragement of Arts, Science  
and Literature in relation to Siam, and neighbouring  
countries.

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List of the Commoner Birds  
found in Siam.

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WITH THE CORRESPONDING SIAMESE NAMES.

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# List of the Commoner Birds found in Siam.

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WITH THE CORRESPONDING SIAMESE NAMES.

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Mr. Crosby's Translation of the "Book of the Birds" (Siam Society, Journal, Vol. VII., Part 2) has, I believe, evoked some interest in the birds of Siam. Seeing that there are some few errors in the Ornithological or English names mentioned by Mr. Crosby, he asked me to prepare a list of the Siamese names I had heard while working in various parts of the country.

Oates in his "Birds of British Burmah" prefaces his list of Burmese names with the remark that "the natives of Burmah have names for only those birds which, from their size, abundance, gaudy plumage or other peculiarities attract notice." This is practically true of every country; but in European countries the migratory birds usually arrive in their best plumage and display greater vocal powers than when wintering in Southern climes; and also in Northern countries their annual re-appearance is far more defined and certain and thus more clearly connected with seasonal change than when coming South after the troubles and trials of family life. Thus in Northern countries the Migratory birds are far better known in the countryside than in Siam. For the 800 genera and species of birds mentioned by Oates he has gathered together some 108 Burmese names. In the present quite incomplete list I have obtained some 90 names, but there are repetitions among these. The names I give are the popular names in the country. More names can, I believe, be obtained at the Museum, but I think they are names not well known to the Siamese. Many Siamese in Bangkok are acquainted with names well known in fable, legend and song, but descriptions are not forthcoming.

In this list the numbers and ornithological names refer to "Birds of British Burmah," 1882, by Eugene Oates. These two volumes describing some 800 birds practically contain all the birds

resident in or migrating to Siam. But to persons unacquainted with the natural orders of Birds and, most difficult of all, the general features of the species of Passerine birds, Oates' book is wearisome, for birds can only be found by a process of elimination.

To persons interested in the study of birds, I would recommend C. McGregor's "Manual of Philippine Birds," to be obtained from the Bureau of Science, Manila. With this at hand classification becomes easy, and a large number of the Passerine birds are common to both countries.

Oates' book can be obtained in London at a cost of about £ 1, and the price of McGregor's book is 8 Philippine dollars.

In the following list I have also shortly described some of the commoner and a few of the rarer birds for which there are no local names, but which sportsmen and others may meet in their travels; and I have also described at some length the 5 genera of snipe as being of interest to the majority of persons resident in Siam.

Seeing how very little is generally or publicly known of the resident or migratory birds in Siam, I hope that this may be considered as a preliminary to further Lists published by the Society at intervals.

As an indication of what may be done in Bangkok alone, I might mention that with the aid of an air gun a small boy collected for me nearly 40 specimens in the months of November and December 1911. These 40 specimens included 29 species, of which only 3 were migratory, viz:—the Golden and Lesser ringed plovers and the Chinese Mynah.

When working up country it is frequently difficult, especially in the rains, to preserve skins of birds. In such cases the following measurements and particulars should be taken as an aid to identification. With the specimen laid flat on its back the length (1) from tip of beak to tip of tail should be taken, (2) length of tail, (3) length of wing from bend of wing to tip of longest primary, (4) the tarsus, (5) the length of beak (i) from gape to tip (ii) from nostril to tip. Then also, in addition to a description of the coloration, the shape of the beak and the formation of the Tarsus and feet are important. The Passerine order of birds can be immediately separated into two sub-orders by an examination of the Tarsi.

(a). Tracheophonae. The Pittas, a small family of most beautifully coloured birds of thrush-like appearance, inhabiting as a rule the darkest evergreen forest, and also the Broadbills. In this sub-order the tarsus has its hinder portion somewhat compressed, but the posterior edge is rounded and entire. (b) The Oscines, which includes the whole of the remaining Passerine Order; in which the Tarsus may have its hinder portion compressed and forming a sharp edge; or else the hinder face will be rounded and distinctly divided by transverse joints.

The Oscines may have the Tarsus "booted," as in the Turdidae, Sylviidae, etc., or it will be "scutellate" as in the Larks, Finches and many other families. The length and direction of the bristles about the mouth should be noted and the cutting edges of the bill may be notched or serrated. In the wing the length of the primaries should be noted—whether the 1st, 2nd, 3rd, or 4th is the longest, or the 1st may be rudimentary.

In describing the plumage the following terms are usually used:—

"Spotted" feathers have the tip a different colour to the remainder of the feather.

"Streaked" feathers have the web next the quill a different colour to the remainder of the feather.

"Barred" feathers have transverse bars of a different colour to the remainder of the feather.

"Margined" feathers have one or both margins a different colour to the remainder of the feather.

The majority of the birds described in the following List have been obtained or observed in the area bounded by North Lat.  $12^{\circ} 40'$  to  $13^{\circ} 10'$  and East Longitude  $99^{\circ} 10'$  to  $99^{\circ} 40'$ , which area includes the sources of the Petchaburi and Pran rivers. The ground level rises from about 70 metres to the highest point on the border range of 1500 metres. The forest and jungle is dense throughout, but East of  $99^{\circ} 25'$  is comparatively dry jungle, containing a good deal of deciduous timber; all West of that line being evergreen jungle with perennial streams running in the valleys. The whole district is practically

uninhabited save for one or two small settlements of Karangs, and the only open spaces in the area are the small patches cleared for cultivation by these people in the bigger valleys. The outline of the country is sharply cut and the majority of the mountains and spurs run directly down to the streams at an angle of 20 to 60°, the valleys being deep, dark, and damp.

The most noticeable birds in the district are the Hornbills; but I was surprised to find small Passerine birds apparently enjoying life on exposed mountain ridges of 3000 and 4000 feet elevation in a cold damp climate, where the higher ridges were enveloped in cloud for 14 days without a break during July; the atmosphere being so thick that it was impossible to see any object clearly at more than 40 yards distance.

Hill partridges were plentiful at the highest elevations, but I never obtained the Silver pheasant at a greater elevation than 700 metres, or the Grey Peacock pheasant at above 500 metres. The latter appears to be only locally plentiful; as it was trapped in considerable quantities in some valleys and never found in others. I do not agree with Oates as to its being a shy bird:—the "sportsman" may find it hard to shoot, but to the hunter it falls an easy prey in the dry season on account of its very loud and oft repeated call.

In addition to the birds mentioned in the following List I have during the past season identified the following, for which there are no Siamese names:—

(3). Orange-headed Ground Thrush (var).

(385). Green breasted Pitta. This and another of the same family not yet identified, obtained in a deep valley, elevation about 400 metres.

(42). Tennasserim Shrike Thrush, on mountainous ridge about 900 m.

(516). Davison's Barbet, elevation about 1000 metres.

(486.) Yellow breasted trogon.

(483). *Anorrhinus Tickelli*. On the 7th August I came across a flock of Hornbills which appear to agree with Tickell's Hornbill; yet Oates states that this bird is only found East of Moulmein.

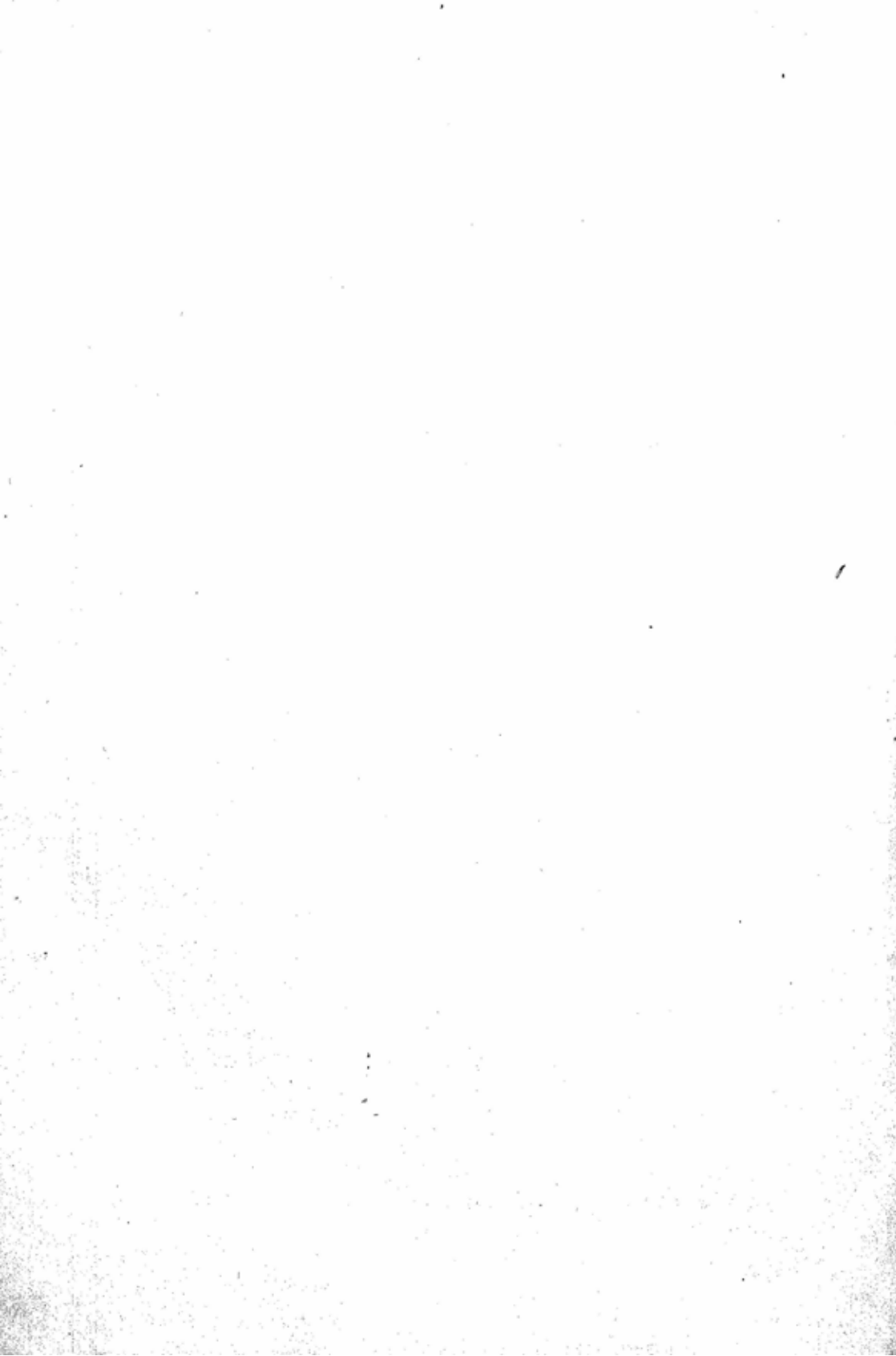
(466). The Pied Kingfisher. This is probably the commonest kingfisher in the country, but I have heard no distinctive name for it.

(462). The little Indian Kingfisher; may be obtained in Bangkok.

(677). Vieillots Fire Back Pheasant (var: erythrophthalmus). Recently I observed a male of this species in a dealer's in Bangkok and on enquiring the name was immediately informed that it was Nok Phya Loah, which is the Siamese name for the Grey Peacock pheasant (No. 673, Oates). The dealer could only tell me that it came from abroad. Oates states that this variety occurs in the Malay Peninsula and may occur in Tennasserim.

(251). The white throated fantail. Elevation 1000 metres.

K. G. GAIRDNER,  
Sept., 1912.



## ORDER : PASSERES.

*Family, Turdidae.*

<i>Ornithl. Name</i>	<i>English Name.</i>	<i>Siamese Name, or Remarks.</i>
10. <i>Monticola cyanus</i> .	Blue rock thrush.	นก กิ้ง เทน ปาก เรียว (Mu- seum)

20. <i>Copsychus</i> <i>musicus</i> .	Malay Magpie Robin.	
--	---------------------	--

นก กระต๊อ ดม หรือ { กิ้ง เทน  
คาง เทน

The sole difference between *C. musicus* and *C. saularis* ( Mr. Crosby ) is that the under wing coverts are white centred with black in the Malayan variety, and pure white in the Indian or Burmese.

21. <i>Cittocincla</i> <i>Macrura</i> .	The Shama.	
--	------------	--

{ กิ้ง เทน This beautiful  
คาง เทน song bird is in  
size and colour  
like the last but has the  
breast chestnut instead of  
white, and a longer tail.

*Family, Timeliidae.*

35. <i>Garrulax</i> <i>diardi</i> .	Siamese white crested laughing thrush.	นก กระ ตาง ( Museum ) อี เพา หัว หง ออก หรือ เจ็ก
--	---	--

โก หก ( Popular names. )

The Siamese bird differs from the Burmese only in the crest being grey and white.

*Families, Sylviidae, Paridae, Sittidae, etc.*

The small Warblers, Titmice and Wrens either resident in Siam or migratory here for the winter months, are usually spoken of as

นก กระ จิบ

*Family, Motacillidae.*

157. *Limoniidromus indicus*. The Forest wagtail. ? นกมดไถ (Mr. Crosby's translation of the Book of the Birds.)
150. *Motacilla Leucopsis*. Pied wagtail. } Both common in Bangkok during the winter months, but no local name apparently.
156. *Budytes calcaratus*. Yellow wagtail. }

*Family, Brachypodidae.*

190. *Pycnonotus blanfordi*. Blanford's or Ashy-fronted Bulbul. นกปรอด The Bulbuls of this species may be easily recognized by the hairs springing from the nape and upper back.
- 197 *Aegithina viridissima*. Green dwarf bulbul, or Black winged iora. นกขมิ้นเหลืองอ่อน This is not a satisfactory local name as the same name is applied to all small birds with a yellow breast, and properly belongs to the Black headed Oriole.
205. *Irena puella*. Fairy blue bird นกประคำฟ้าเงิน (Museum B'kok)

*Family, Oriolidae.*

208. *Oriolus melanocephalus*. The black headed Oriole. นกขมิ้นเหลืองอ่อน The golden oriole is common all over the country.

*Family, Dicruridae.*

212. *Buchanga atra*. The Black Drongo or King Crow. นกเขนง This name is applied to all the members of this family.

218. *Dissemurus* Great Racket Tailed นก แว่ง แว่ง หาง บ่วง  
*Paradiseus.* Drongo.

*Family, Laniidae.*

236. *Lanius nasutus.* Black headed shrike. นก หัว เลื้อย

*Family, Muscicapidae.*

252. *Rhipidura* The Java Fantail. นก กระตักดิน Easily recog-  
*javanica.* nized from its habit of  
dancing about from branch  
to branch with tail out-  
spread. Sooty brown, lower  
plumage white.

*Family, Hirundinidae.*

293. *Hypurolepis* Tropical House นก อี๋ แอ่น This name ap-  
*javanica.* Swallow. plies to all the swallows ;  
*H. javanica* is the only one  
I have so far examined.

*Family, Nectariniidae.*

303. *Cinnyris* Yellow breasted นก กระ จีบ แดง  
*flammaxillaris.* Sun bird.

*Family, Dicaeidae.*

314. *Dicaeum* Scarlet backed นก สีส้ม พู  
*cruentatum.* flower pecker.

*Family, Fringillidae.*

328. *Passer Indicus* Indian House นก กระจอกเทศ I have only  
(var *flavicollis*). sparrow. once heard this local name  
given ; and this is also the  
slang name for the Ostrich.

329. *Passer* European tree นก กระ จอก  
*Montanus.* sparrow.

*Family, Ploceidae.*

337. *Ploceus Baya*.      The Baya or      นกกระเจา      The male in  
Weaver bird,      winter loses the yellow  
plumage on the head and is  
then known as the "Paddy  
bird."

*Family, Alaudidae.*

348. *Alauda*      Formosan      กะเต้านม  
*wattersi*.      Skylark.

*Family, Sturnidae.*

- |                          |              |  |
|--------------------------|--------------|--|
| 352. <i>Gracupica</i>    | Black necked | }      นกกิ้งโครง Both these birds<br>are common in Bangkok,<br>the former with a pure<br>white head and rather<br>larger than the second. |
| <i>nigricollis</i> .     | Mynah.       |  |
| 353. <i>Sturnopastor</i> | Burmese Pied | }  |
| <i>super ciliaris</i> .  | Mynah.       |  |

354. *Acridotheres*      The house Mynah.      นกของบ้าน or ต้าดก้า I have  
*Tristis*.      never seen this bird in  
Bangkok but it is common  
around villages up country.  
The Burmese name for the  
Talking Mynah is Tha-lec-  
gah (Oates.)

356. *Acridotheres*      The Siamese      นกเขียวก      Black with a white  
*Siamensis*.      Mynah.      patch on either wing, a com-  
mon pet in Siamese houses.

359. *Sturnia*      The Chinese      กิ้งโครง This bird is seen in  
*Sinensis*.      Mynah.      small flocks from November  
to February only, and may  
be recognized from the soft  
grey and white plumage.

- |              |                |  |
|--------------|----------------|--|
| 365. Gracula | The Burmese    | } <span>นกขุนทอง</span> I am unable to say which of these varieties predominate in Siam; the latter is a more massive bird. The respective lengths are 11.6 and 12.5 inches. |
| Intermedia.  | Talking Mynah. |  |
| 366. Gracula | The Malay      |  |
| Javanensis.  | Talking Mynah. |  |

*Family, Artamidae.*

- |              |                 |                      |
|--------------|-----------------|----------------------|
| 369. Artamus | Swallow-shrike. | <span>นกขมิ้น</span> |
| Fuscus.      |                 |                      |

*Family, Corvidae.*

- |                            |                     |   |
|----------------------------|---------------------|---|
| 370. Corvus Macrorhynchus. | Indian Jungle crow. | } <span>นกอีกา</span> I believe the same local name serves both birds. The Jungle crow is the larger, measuring 19" and the House crow 17.5 inches. The latter I have only noticed this year for the first time, in Pechaburi town. |
| 372. Corvus Insolens.      | Burmese House crow. |   |

*Family, Eurylaemidae.*

- |                            |                        |  |
|----------------------------|------------------------|--|
| 397. Eurylaemus Javanicus. | Horsfield's Broadbill. | (Museum, Bangkok).   |
| 400. Corydon Sumatranus.   | Dusky Broadbill.       | I have seen and obtained two pairs of these birds in dense Forest; and apparently there is no Siamese name. The bill is as wide at the the gape as it is long. |

## II. ORDER: MACROCHIRES.

*Family, Caprimulgidae.*

414. *Caprimulgus* Common Indian Very common,  
asiaticus. Nightjar. นกน้ำค้าง call like a stone  
scudding over ice.
419. *Lyncornis* Burmese Eared Found only  
*Cerviniceps*. Nightjar. นกปากกว้าง in hilly or  
forest country. Call a plain-  
tive "Pee Pew."

## III. ORDER: PICI.

Of the 30 odd genera of Woodpeckers inhabiting Siam I cannot remember having heard any distinctive names for the various genera. The general name is นกพิทข้วน

## IV. ORDER: COCCYGES.

*Family, Upupidae.*

454. *Upupa longirostris*. Burmese Hoopoe. นกฮoopoe Common in open  
jungle.

*Family, Meropidae.*

458. *Merops* Blue tailed bee eater. นกตบถ This is the only  
*Philippinus*. name I have heard  
for the various bee eaters.

*Family, Coraciidae.*

460. *Coracias affinis*. Burmese roller or นกกระเตย  
"Blue-jay."

*Family, Alcedinidae.*

The common name for all Kingfishers (14 genera) is นกอินปลี

468. *Pelargopsis* Burmese Stork-billed นกสามกวาง The biggest  
*Burmanica*. Kingfisher. of the heavi-  
er Kingfishers, with blue  
back and mustard coloured  
breast.

- นก กะเต็น

- นกกาฬหรือนกเงือก This, the biggest of the Family, measures 51 inches long, and is easily recognized by the creaking of its wings when flying and its call, a loud staccato bray.

- Length 9.5. Black barred with Chestnut. I obtained one of these 27/12/11 in Bangkok for the first time. No local name.

๙๓ มิวส์ (Museum, B'kok.)

นก กาเหว่า or ค เหว่า Fre-  
quently caged as a pet in  
Siam.

509. *Centroccocyx intermedius*. Burmese Coucal or Crow Pheasant. นก ๑๓ (Burmese name "Bote"). The country folk credit this bird with calling at regular intervals during the night, viz., the 1st, 2nd, 3rd and 4th watches.
510. *Centroccocyx bengalensis*. Lesser Coucal. นก กค ชั่ว  
*Family, Capitonidae.*
514. *Cyanops Hodgsoni*. Lineated Barbet. นก โพ ระดก The loud and wearisome note of this bird is well known to travellers in the jungle. An incessant "ko-poh, ko-poh" throughout the day.
519. *Xantholaema haemacephala*. Crimson gorgeted Barbet or "Coppersmith." นก ตีทอง Common in garden land.
- V. ORDER: PSITTACI.
526. *Palaeornis Cyanocephalus*. Burmese rose-headed paroquet. นก แก้ว Length, 13.5".
528. *Psittinus incertus*. Malayan Parrot. นก กะลิง Length, 7.5".  
Mr. Crosby's นก แดง เต้า  
1 have not yet identified.

## VI. STRIGES.

*Family, Bubonidae.*

534. *Bubo orientalis*. Horned owl. } นก ที่ด ที่อ { Length 18"  
533. „ *nipalensis*. Forest horned owl } นก ดำ มั่น ทิด { Length 24"
536. *Scops lettia*. Nipal Scops owl. Length 9"
537. *Scops lempiji*. Horsfield's Scops owl. นก เคา กู หรือ กิน ผี Length 7½"

541. *Glaucidium brodiei* Collared Pygmy owl. นกเค้าแมว Length 6.3"  
 546. *Strix flammea*. Barn owl. นกเค้า Length 14.5"

All the eared owls are spoken of as นกเค้า

## VII. ACCIPITRES.

*Family, Vulturidae.*

549. *Pseudogyps bengalensis*. Indian white backed Vulture. อีแร้ง  
 550. *Otogyps calvus*. Black Vulture. อีแร้งเจ้าพระยา

*Family, Falconidae (อีเหยี่ยว)*

551. *Circus melano-leucus*. Pied Harrier. This black and white harrier is frequently seen at the Sports Club in winter months.  
 The Eagles. นกอินทรี general name.  
 558. *Accipiter nisus*. Sparrow hawk. อีเหยี่ยว นกเขา  
 568. *Spilornis cheela*. Crested serpent eagle. นกอีแร้ง Length 26".  
 575. *Haliastur Indus*. Brahminy kite. อีเหยี่ยวแดง  
 576. *Milvus affinis*. Smaller house kite. " ดำ  
 577. *Milvus melanotis*. Large jungle kite. " ดำ  
 578. *Elanus Caeruleus*. Black-shouldered kite. อีเหยี่ยว นกเขา This beautiful grey and white bird I obtained only in Dec. 1911 in Bangkok.  
 581. *Baza Lophotes*. Black-crested kite falcon. A flock seen in Bejaburi, 1910.  
 584. *Microhierax fringillarius*. Black-legged falconet. อีเหยี่ยวตะไกร Length 6"  
 Black and white.  
 589. *Tinnunculus alaudarius*. Kestrel. อีเหยี่ยว ยะว้า

SUB-ORDER : PANDIONES.

591. Pandion                The Osprey.      นก อินทรี Oates states that  
Haliaëtus.          this is probably only a  
winter visitor to Burmah. I  
have shot it and observed  
others in April and May.

## VIII. STEGANOPODES.

Family, *Phalacrocoracidae*:

602. *P. carbo*. The large Cormorant. length 32" { นกกระเรียน, both  
604. *P. Pygmaeus* The little Cormorant. " 20" {  
to be met with in Nongs  
and streams up-country.

*Family, Pelecanidae.*

- |                              |                         |   |
|------------------------------|-------------------------|---|
| 606. <i>P. Manillensis</i> . | Spotted billed Pelican. | { <span style="font-size: 2em; vertical-align: middle;">{</span> ၁၈၈၇၅၂ I have only seen<br>one pair in Ratburi; but<br>they are said to be com-<br>mon in that district dur-<br>ing the rains. |
| 607. <i>P. Roseus</i> .      | Eastern white Pelican.  |   |

## IX. HERODIONES.

Family, *Ardeidae*.

- |                              |                              |   |
|------------------------------|------------------------------|---|
| 608. Ardea Cinerea.          | The Grey or<br>Common Heron. | นก กา ห่อ This name ap-<br>plies to all Herons. |
| 609. Ardea<br>Sumatrana.     | Great Slaty Heron.           | ? length 50"                                    |
| 616. Bubulcus<br>coromandus. | Cattle Egret.                | นก ช้าง เหยี่ยว                                 |
| 617. Ardeola Grayi.          | The Pond Heron.              | นก ยาง  |
| 621. Ardetta<br>Cinnamomea.  | Chestnut bittern.            | นก ยาง กว๊าก                                    |

609. *Ardea* Great Slaty Heron. ? length 50"  
Sumatrana.

Sumatrana.

- |                      |               |         |
|----------------------|---------------|---------|
| 616. <i>Bubulcus</i> | Cattle Egret. | นกยางดำ |
| <i>coromandus.</i>   |               |         |

517. *Ardeola Grayi*. The Pond Heron. นก ยาง

621. *Ardetta* Chestnut bittorn. นกยางกรอก  
*Cinnamomea*.

Family, Ciconiidae.

- |                   |                |          |                  |
|-------------------|----------------|----------|------------------|
| 626. Leptoptilus  | Adjutant bird. | นกกระทุง | Length 60 inches |
| Argala.           |                |          |                  |
| 627. „ javanicus. | Lesser do.     | „        | 54 „             |

627.	„ javanicus.	Lesser do.	54
------	--------------	------------	----

628. *Xenorhynchus asiaticus*. Black-necked stork. นก กัด เพ็ดจิง (Cartwright)  
 นก สาย บัว Pachin. There is one of these in the possession of Mr. W. G. Johnson, obtained as a nestling in 1909 at Bejaburi. Length 52".
629. *Dissura episcopus*. White-necked stork. นก กัด เพ็ดจิง แดงบ { Fairly common in Ratburi; length 36"  
 นก คอ คาน

*Family, Tantalidae.*

630. *Anastomus oscitans*. The shell ibis. นก ปาก ห้าง
631. *Tantalus leucocephalus*. Pelican ibis. } ขอน หอย หรือ คอกบัว white with black about body.
632. *Ibis melanocephala*. White ibis. } เก็ด็ด หอย white with black head.
- *Ibis gigantea*. Thawmat Ibis. I have only seen one of these; if found the skin should be preserved as it is a very rare bird. Dark brown; blue head.

## X. ANSERES.

*Family, Anatidae.*

635. *Nettapus coromandelianus*. Cotton Teal goose. นก คับ แด Length 13"
636. *Dendrocygna javanica*. Lesser whistling teal. นก เป็ด น้ำ Length 16"
647. *Querquedula circia*. Garganey teal. A pair shot at Potaram, Ratburi, in Feb. 1908. No local name.

## XI. COLUMBAE.

*Family, Columbidae.*

- |                              |                               |   |
|------------------------------|-------------------------------|---|
| 651. Turtur<br>Tigrinus.     | Malay spotted dove.           | นกเขา   |
| 654. Turtur<br>humilis.      | Eastern ruddy ring<br>dove.   | นกเขาไฟ   |
| 658. Geopelia<br>striata.    | Barred ground<br>dove.        | นกเขาชะวา   |
| 660. Carpophaga<br>aenea.    | Imperial green<br>pigeon.     | } นกเขาแปดตัว<br>} นกดำ   |
| 650. Alsocomus.<br>Puniceus. | The Purple<br>wood pigeon.    |   |
| 665. Treron<br>nipalensis.   | Thick-billed green<br>pigeon. | The 5 or 6 green pigeons<br>occurring in Siam are all<br>called นกเขาเขียว. This is<br>the most common. |

## XII. GALLINAE.

*Family, Phasianidae.*

- |                                  |                              |   |
|----------------------------------|------------------------------|---|
| 671. Pavo muticus.               | Burmese peafowl.             | นกยูง   |
| 672. Argusianus<br>Argus.        | Argus pheasant.              | นกพญา Plentiful in the<br>Malay Peninsula.  |
| 673. Polyplectron<br>thibetanum. | Grey Peacock<br>pheasant.    | นกพญายา This and the<br>next are common in the<br>dense evergreen forests of<br>Tennasserim border. |
| 674. Euplocamus<br>lineatus.     | Lineated silver<br>pheasant. | นกไก่งวง  |

- |                 |                     |   |
|-----------------|---------------------|---|
| 675. Euplocamus | Arrakan silver      | These also occur, but I<br>have heard no distinctive<br>names for them. |
| cuvieri.        | pheasant.           |   |
| 676. Euplocamus | Anderson's silver   |   |
| andersoni.      | pheasant.           |   |
| 677. Euplocamus | Vieillot's Fireback |   |
| vieilloti.      | pheasant.           |   |
| 678. Gallus     | Common jungle       | ไก่ป่า  |
| ferrugineus.    | fowl.               |   |

*Family, Tetraonidae.*

- |                  |                    |  |
|------------------|--------------------|--|
| 679. Francolinus | Chinese Francolin. | นก กระเทย  |
| chinensis.       |                    |  |
| 684. Caloperdix  | Ferruginous wood   | นก กระพาด This bird's loud<br>note is frequently heard in<br>the dense evergreen forests<br>on the Tennasserim border. |
| oculea.          | Partridge.         |  |
| 685. Rollulus    | Red crested Hill   | Same local name as the<br>last.  |
| Rouloul.         | Partridge.         |  |
| 689. Turnix      | Blanford's button  | นก คุ่ม  |
| maeulosa.        | quail.             |  |

### XIII. GERANOMORPHAE.

*Family, Rallidae.*

- |                |                    |  |
|----------------|--------------------|--|
| 694. Rallina   | Malay Banded Rail. | อี ตุ่ม หรือ ไก่ นา  |
| Fasciata.      |                    |  |
| 700. Erythrura | White-breasted     | นก แววก หรือ ขวาก  |
| phoenicura.    | waterhen.          |  |
| 701. Gallicrex | The Watercock.     | นก พรึก  |
| cinereus.      |                    |  |
| 702. Porphyrio | Indian Gallinule.  | อี ไก่ This bird may be<br>recognized by the hard red<br>shield on the top of the<br>head. |
| Poliocephalus. |                    |  |

## SUB-ORDER: ALECTORIDES.

*Family, Gruidae.*705. *Grus Antigone*. The Sarus crane.

นกกระเรียน (incorrectly translated as the "adjutant bird" by Mr. Crosby).

This beautiful Crane (the only Crane in Siam) has a wide range, from India to Cochin-China. The colour is greyish blue, with a brick red head. Height, 55". Pairs are frequently kept in Bangkok. It is said to occur in the plains south of Pachi in large flocks during the breeding season (August).

## ORDER XIV: LIMICOLAE.

*Family, Parridae.*708. *Metopidius*  
*Indicus*.Bronze-winged  
jacana.นกพริก Length, 10.5 in.  
Usually found walking on floating plants in swamps.

The note is a peculiar bloop-bloop.

709. *Hydrophasianus* Pheasant tailed do.  
*chirurgus*.

นกพริก Chiefly white and occurs in flocks in February and March.

*Family, Charadriidae.*712. *Charadrius*  
*fulvus*.Eastern Golden  
Plover.

นกขมิ้น Common during the winter months only.

717. *Aegialitis*  
*dubia*.Lesser ringed  
Plover.

Probably does not remain in Siam the year round, but common during the winter months. Length, 6.5 inches.



Gallinago  
nemoricola.

Wood snipe.

Length  $12\frac{1}{2}$  to 13"

730. Rhynchaea  
capensis.

Painted Snipe.

Length 10", Tail 1.7"  
Probably breeds in Siam.

XV. ORDER: GAVIAE.

XVI. ORDER: TUBINARES.

I know no names for the Sea Birds.

ORDER XVII: PYGOPODES.

*Family, Podicipidae.*

780. Tachybates  
Fluviatilis.

The little Grebe.

Length 9"; no tail.  
I believe this is called  
นกเป็ดน้ำ

### ADDENDA.

XI. ORDER: COLUMBAE.

661. Carpophaga  
Griseicapilla.

Grey headed

นก حمام. Head dove-grey  
Imperial Pigeon. chin white. Back and,  
wing coverts rufous. Breast  
grey. Length  $17\frac{1}{2}$ ". Wing  
 $9\frac{1}{2}$ ". Call, very deep "k—  
woob—woom." A pair shot  
at an elevation of 3,500 feet.  
Lat.  $12^{\circ}40'$ . Tennasserim  
border.

657. Chalcophaps      The Emerald dove  
Indica.                      (Oates).

นกเขียว. Head, neck,  
breast and under wing  
coverts deep chestnut. Tail  
maroon. Wing coverts,  
scaps, terts and back, eme-  
erald green. Bill, crimson.  
Found in the valleys of  
dense evergreen Forest.

592. Polioaetus  
ichthyaetus.

Bar Tailed Fishing  
Eagle.

The name นก ปลา is also  
applied to this. Length 29"

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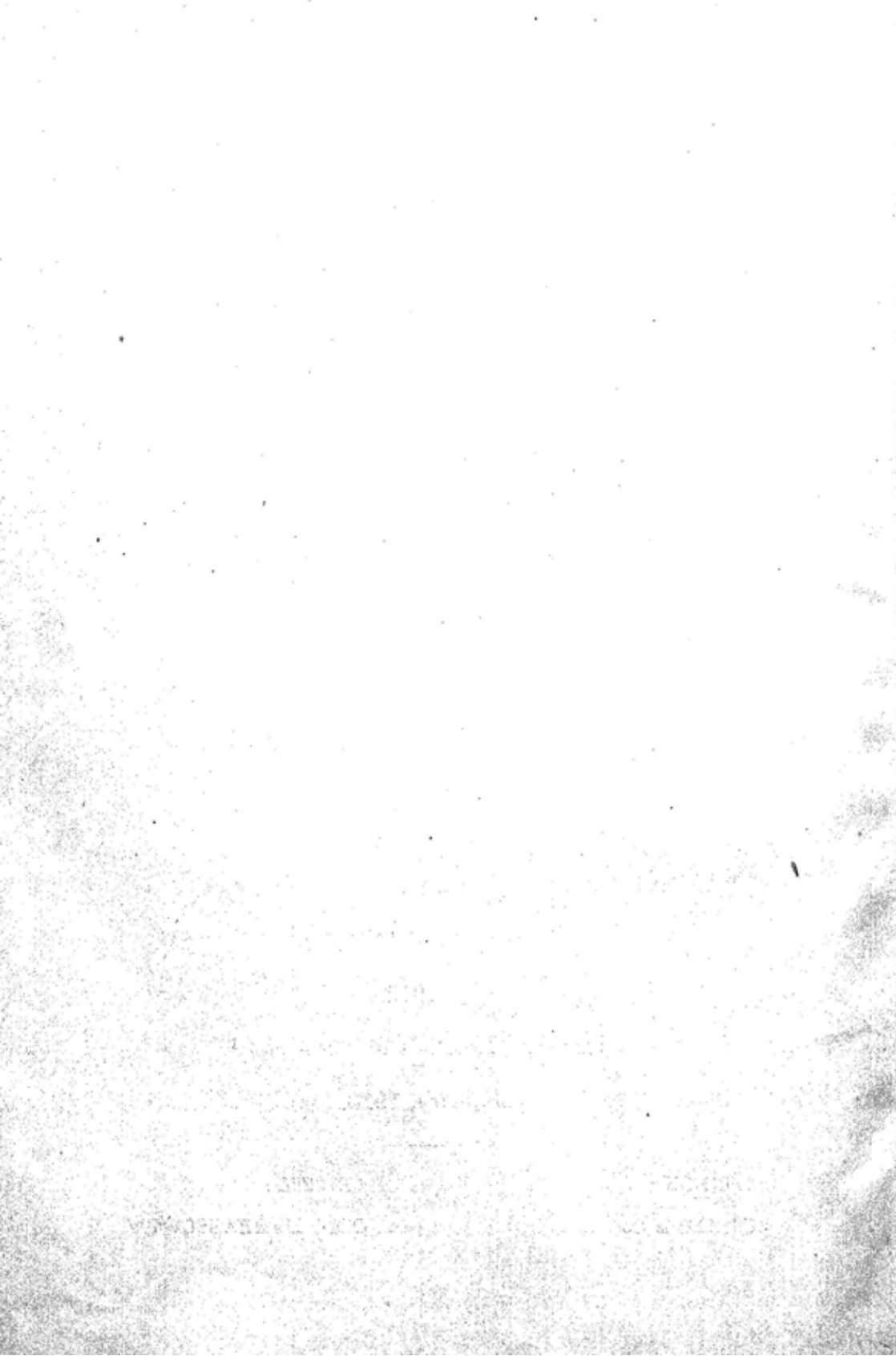
BANGKOK  
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# THE SIAM SOCIETY.

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(FOUNDED 1904.)

For the Investigation and Encouragement of Arts, Science  
and Literature in relation to Siam, and neighbouring  
countries.

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# THE CLIMATE OF BANGKOK.

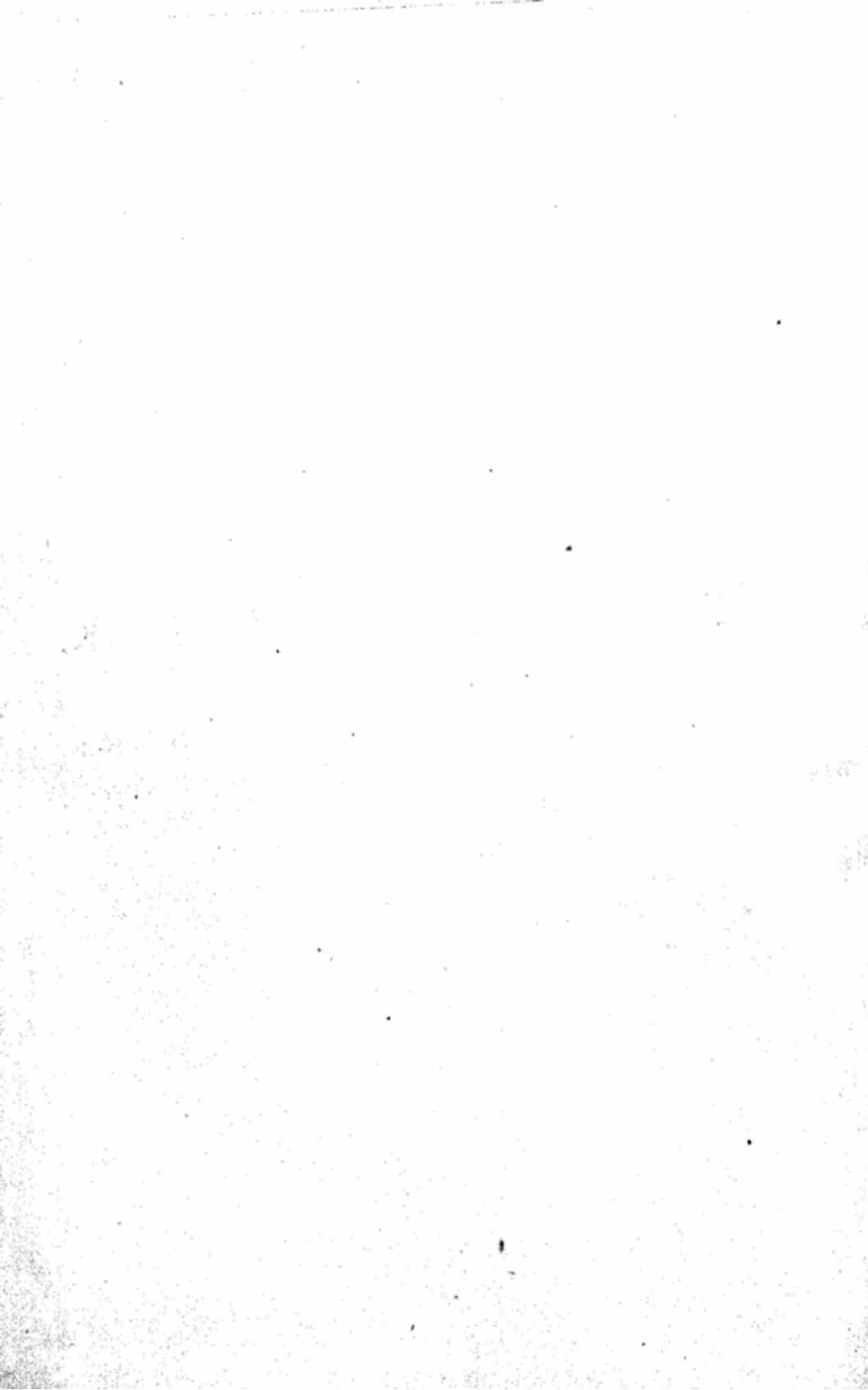
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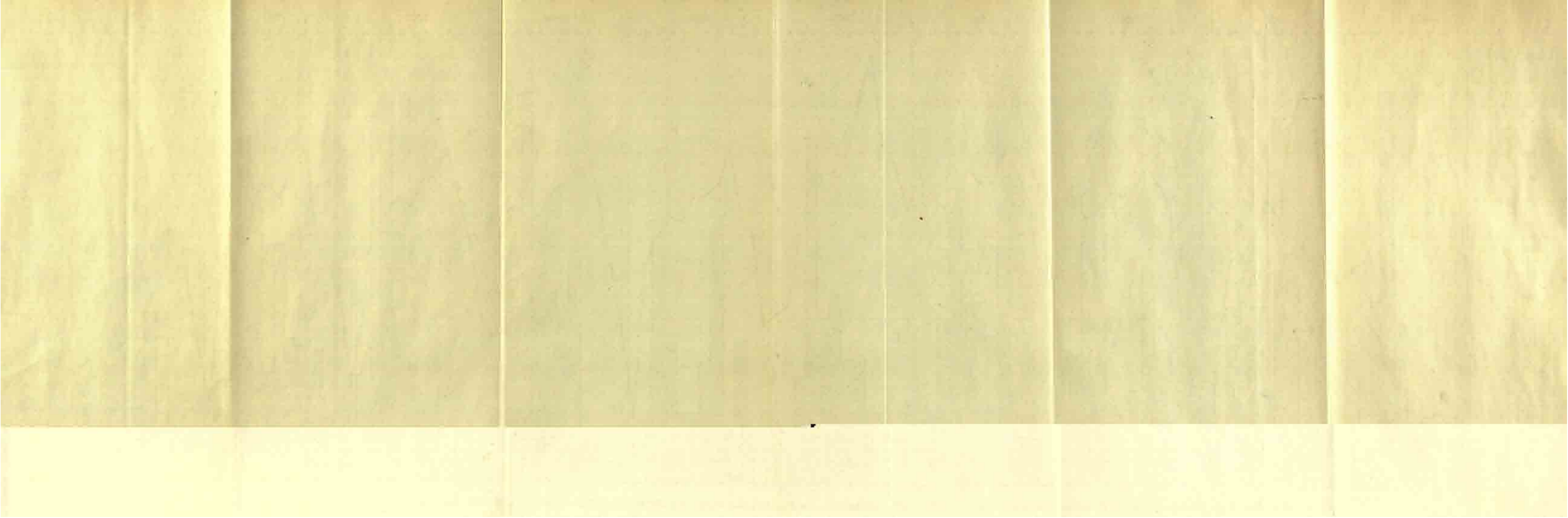
Principal Medical Officer Local Sanitary Department Bangkok,  
Vice-President, Far Eastern Association of Tropical Medicine,

Fellow of the Royal Institute of Public Health,

Fellow of the Society of Tropical Medicine and Hygiene.







# The Climate of Bangkok.

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The following notes upon temperature and rainfall are offered as a small contribution towards the complete study of all the climatic conditions which obtain in the City of Bangkok. They are based upon daily records taken during the last ten years, that is 1902 to 1911 inclusive. During the majority of these years, the instruments have been located in the compound of the Police Hospital. The daily readings have been taken by Mr. E. A. Bryan, the Resident Surgeon, and I am glad to have this opportunity of thanking him for his very valuable assistance.

The thermometers are all "Kew-tested" and can be relied upon, and those for recording shade temperatures are kept in a double roofed louvered box, four feet above the ground, on the lawn of the hospital.

## GENERAL CONSIDERATIONS.

Bangkok, the Capital of Siam, is situated on both banks of the river Menam Chow Phya, some forty Kilometers above the bar following the windings of the river, but only 22.5 Kilometres in a direct line from the bar, in latitude  $13^{\circ} 58'$  N., and longitude  $100^{\circ} 34'$  E.

The mean level of the city is only about 4.25 metres above mean sea level.

The numerous canals which intersect it show a difference between ordinary high and low tides of only 1.8 metre and at Spring Tides of 2 metres.

During the high tides of November, December and January, considerable portions of the city are subject to inundation, especially during years of heavy rainfall.

The Monsoons naturally divide the year into a dry and a wet season. The South-West Monsoon is said to blow from April to September, but in Bangkok, its onset with the accompanying rains is

somewhat variable as may be shown by the following data giving the advent of the rains during the ten years under review:—

Approximate Dates upon which the Rains commenced.

Year	Date
1902	2nd May
1903	8th „
1904	2nd „
1905	11th „
1906	10th „
1907	2nd „
1908	10th „
1909	30th April
1910	11th May
1911	4th „

During several of these years, frequent showers during April preceded the real advent of the rains, and in fact about the 20th April, one or more heavy showers of rain accompanied by thunder may be expected. As a rule, from this date until the rains break, the climate of Bangkok is at its worst. The temperature during the twenty-four hours is high, the air is humid, and breezes are light or absent. The onset of the rains may be fairly sudden, and after several weeks of rainless hot days the first heavy shower often occurs during the night. This was particularly the case in May, 1903, when after a complete absence of rain during March and April, a fall of 4.5 inches was recorded from about 10 p. m. on the 7th. until 5 a. m. on the 8th. In Bangkok it may be said that the South-West Monsoon lasts from the end of April or beginning of May until the end of October, which period coincides with the rainy season. During this season, the temperature tends to be more uniform than during the dry season, the daily maxima are lower, the minima higher, and naturally the range is less, giving therefore a greater monotony of climate.

During November, the actual date varying considerably, the North-East Monsoon sets in in Bangkok, and may continue to blow fairly regularly during December and January and perhaps a greater

portion of February. It is during this period that our much appreciated "Cool Season" is experienced. In the minds of dwellers in Singapore and other adjacent countries, our cool season still remains somewhat of a myth. True it is that in some years, the temperature fails to fall to reasonable figures for a longer period than a week or two, but on the other hand during a normal December and January, the climate of Bangkok is a very agreeable one.

The mean temperature in the shade for the ten years is  $82.98^{\circ}\text{F}$  ( $28.3^{\circ}\text{C}$ ) while the highest figure in the shade was  $106^{\circ}\text{F}$  ( $41.1^{\circ}\text{C}$ ). This temperature was recorded during the year 1906 on four occasions, *i. e.* on the 26th February, the 8th and 19th April and the 7th May as may be seen from Chart I.

The lowest temperature in the shade was recorded on the 21st December 1907 and amounted to  $52^{\circ}\text{F}$  ( $11.1^{\circ}\text{C}$ ). We have thus an absolute range of shade temperatures of  $54^{\circ}\text{F}$  or  $30^{\circ}\text{C}$ .

The maximum of the daily solar radiation temperatures ranged from  $169^{\circ}\text{F}$  ( $76.1^{\circ}\text{C}$ ) on the 1st August 1911 to  $82^{\circ}\text{F}$  ( $27.8^{\circ}\text{C}$ ) on the 14th May 1908.

The mean rainfall for the ten years is 57.139 inches (1450.8 m.m.), the range being from 45.95 inches (1167.1 m.m.) in 1906 to 72.13 inches (1831.8 m.m.) in 1908. May and September are the two wettest months of the year as a rule.\*

Hail fell on the 7th April 1904, a phenomenon which is said to occur only once in ten years in Bangkok.

Towards the beginning and the end of the South-West Monsoon, the frequent heavy showers of rain are usually preceded and accompanied by fairly strong winds and by thunder and lightning.

Typhoons are unknown in Bangkok, but on one occasion in the writer's experience, a tornado of limited area, but of considerable force, was experienced in Bangkok. This was on the 31st March 1911 when at about 1.30 p.m., heavy clouds were seen to bank up towards the North and North-East, and strong winds began to blow, at first from the North-East. The storm passed across the compound of the Police School with considerable violence but doing no damage at this time,

---

\* See Charts I., II., III. and Frontispiece.

and then seems to have described a circle, passing westwards over the Suan Luang to Pomprab district, thence North-West to Nang Lerng District, East to Khor Sua and back South-East to the Police School again when it seems to have attained its maximum violence. At the School there is a double row of three barracks running West and East each raised on wooden pillars ten feet from the ground. Of the northern row, barracks No. 1 and 2, counting from the Western end, were lifted from their foundations and overturned and the same fate befel No. 2 of the Southern row. Number one of this row was badly shaken and was left standing at a considerable angle from the perpendicular. All the other buildings were left intact although the nearest was less than fifty yards from those blown down.

Three men were killed by the falling buildings and over twenty constables sustained injuries of a more or less serious nature.

#### PREVIOUS METEOROLOGICAL RECORDS.

The only previous records of temperature and rainfall known to me are two, namely those compiled by the Rev. Jesse Caswell, an American Missionary, and those recorded by Dr. James Campbell—Physician to the British Legation. In the "Bangkok Calendar" for 1860, the Rev. Dr. D. B. Bradley, the Editor, writes as follows under the heading "Meteorological Tables":—

"The four following tables were prepared by the Rev. Jesse Caswell, formerly a Missionary of the A. B. C. F. M., but afterwards under the patronage of the American Missionary Association, New York. The compiler can testify from personal knowledge, that the observations were made with great care and labor, but for the want of a self-registering instrument, it was impossible for him to make them as accurate as the tables following them, made by Dr. Campbell."

In the same number of the Calendar, Doctor Campbell writes thus to Dr. Bradley.

Bangkok January 1st 1859

My Dear Doctor,

"Enclosed I send you the various items I record, condensed into monthly tables and think them to be as copious as you will require for the object in view.

“ The temperatures I believe to be the most correct of any recorded for Bangkok: for I take it those hitherto noted were not from self-registering instruments, or if so, that they were not so accurate as those now made.

“ My thermometers were tested at Kew and Greenwich observatories. The same remarks apply to the Hygrometer.”

With regard to the Rev. Mr. Caswell's data which cover the year 1840-47 inclusive, one cannot but commend the indefatigable labour and care taken in the recording of these figures.

In the absence of self-registering instruments, it is difficult to imagine how with his ordinary duties to perform, Mr. Caswell could find time to make such careful records. His mean temperature for eight years is  $81.14^{\circ}$  F, that of Dr. Campbell for 10 years 1858 to 1868 (circa), is  $80.1^{\circ}$  F, and my mean for 10 years 1902 to 1911 is  $82.9^{\circ}$  F, all closely approximating.

It may be further noted that Mr. Caswell's extremes were  $97^{\circ}$  F and  $54^{\circ}$  F, a range of  $43^{\circ}$  F, which is  $11^{\circ}$  F below my extreme range. Taken under such difficulties, it would be useless to form any definite conclusions upon Mr. Caswell's figures.

With regard to Dr. Campbell's data, however, the facts are reliable, taken as they were by a careful observer with self-registering instruments previously tested at Kew and Greenwich Observatories.

In a former publication on “ Climate and Health in Bangkok ” read before the Siam Society, I referred to ten years records of Dr. Campbell in the possession of the Royal Meteorological Society of England, and hazarded the opinion that considering their lesser range than my figures, the location of the instruments might possibly have been a shaded verandah in place of in the open air under the shade of the regulation double-roofed louvred box in which my instruments have always been kept.

Unfortunately, we have no records of Dr. Campbell's extremes of maxima and minima but on looking at Chart I, it will be seen that his figures show a lesser range generally than mine. The only exceptions are that his mean of minima for November and December are slightly lower than mine. There is a difference, too, in the rainfall

averages (see Chart II) Dr. Campbell's being 67.04 inches, mine being 57.14 inches.

One might well ask has the climate of Bangkok changed during the last forty to fifty years?

The two periods in question are not long enough to enable one to make any reliable comparison, but it should be at least noted that the lesser range of temperature in Dr. Campbell's records is accompanied by a higher rainfall, while my ten years' averages give a higher range of temperature and a rainfall lower by ten inches.

If it could be proven that any great extent of destruction of forests had taken place during the past fifty years around Bangkok, then such a change in climate would be just what one would expect; for it is well known that in forest districts, the minima are constantly higher and the maxima constantly lower, and that the range is consequently less than in regions not covered with wood, and that the rainfall is greater than over ground bare of trees. Unfortunately I have been unable to obtain reliable data with regard to any extensive disafforestation in and around Bangkok within the period about mentioned. Until reliable records have been taken during many more decades, it will be impossible to make any emphatic statement as to any local change of climate.

To those who do not care to consult the tables of temperature and rainfall provided as appendices, the following abstract of the climatic conditions for each month may be of interest.

#### MONTHLY ABSTRACT OF CLIMATIC CONDITIONS IN BANGKOK.

*January.* The mean temperature in the shade is  $79^{\circ}\text{F}$  or  $26.1^{\circ}\text{C}$ , the mean of the maxima  $92.1^{\circ}\text{F}$  ( $33.3^{\circ}\text{C}$ ), the mean of the minima  $66.7^{\circ}\text{F}$  ( $19.3^{\circ}\text{C}$ ), the mean daily range  $25.4^{\circ}\text{F}$  ( $14.1^{\circ}\text{C}$ ) while the mean solar radiation temperature amounts to  $139^{\circ}\text{F}$  ( $59^{\circ}\text{C}$ ). During this month, the highest temperature in the shade was  $100^{\circ}\text{F}$  ( $37.8^{\circ}\text{C}$ ) during five days in 1906 and on one day in 1907 and the lowest in the shade  $54^{\circ}\text{F}$  ( $12.6^{\circ}\text{C}$ ) on the 22nd., 1904. This is the month during which we experience the greatest mean daily range between the maximum and minimum shade temperatures. The maximum range for the month was  $40^{\circ}\text{F}$  ( $22.2^{\circ}\text{C}$ ) in 1907, while the minimum was  $14^{\circ}\text{F}$  ( $7.7^{\circ}\text{C}$ ) in 1907.

This month is also marked by the least mean rainfall, the mean for the 10 years being 0.25 inch (6.4 millimetres). The average number of days on which rain falls is 1.5 and the greatest rainfall in any 24 hours during this month amounted to 0.98 inch (25. m.m.) and was recorded on the 24th., 1910.

As might be expected with such slight rain, the mean relative atmospheric humidity for the month is only 68 per centum.

The wind is generally from the N., N. N. E and sometimes S. S. W,—S.

*February.* The mean shade temperature is 81.2° F (27.3° C), the mean of the maxima 93° F (33.9° C), the mean of the minima 70.2° F (21.2° C), while the mean solar radiation figure is 138° F (58.8° C). The extremes are 106° F (41.1° C) in the shade in 1906 and 56° F (13.3° C) in 1902.

The mean daily range is 22.7° F (12.6° C), less than January. The greatest range recorded during the ten years was that of 41° F. (22.7° C) on the 3rd February 1908.

During this month we also find the least range recorded—namely 3° F. (1.6° C) on the 4th of 1902. On the previous day, there had been a few drops of rain with a maximum of 84° F. in the shade. On this the 4th, rain fell in a drizzle to the extent of 0.4 inch. The solar radiation figure was only 87° F. (30.6° C), the maximum in shade 68° F. (20° C) and the mean for 24 hours 65.8° F. (18.7° C).

The mean rainfall is slightly over that of the previous month being 0.67 inch (17 m.m.) and the mean number of days on which rain falls is two. This rainfall is generally limited to a few slight showers—the well known “Mango Showers”—but occasionally quite a heavy fall has been recorded, as for example 1.65 inch (41.9 m.m.) on the 21st of 1911 and 2.47 inch (62.8 m.m.) on the 25th of 1910.

The mean relative atmospheric humidity is 60.4 %.

The wind blows from the N. E., E. or S. S. E. and rarely from the South.

*March.* Higher than in January, or February, the mean temperature is 84.7° F (29.3° C), the mean of maxima 94.7° F (34.8° C),

and the mean of minima  $73.2^{\circ}\text{F}$  ( $23^{\circ}\text{C}$ ), all shade readings. The mean solar radiation temperature is  $143^{\circ}\text{F}$ , the highest being  $162^{\circ}\text{F}$  in 1903 and the lowest  $87^{\circ}\text{F}$  in 1907.

The highest maximum in the shade was  $103^{\circ}\text{F}$  ( $39.4^{\circ}\text{C}$ ) on the 31st of 1903, the lowest minimum  $62^{\circ}\text{F}$  ( $16.7^{\circ}\text{C}$ ) on the 22nd of 1908.

The daily range is lessening, the mean being  $20.6^{\circ}\text{F}$  ( $11.4^{\circ}\text{C}$ ) the greatest  $37^{\circ}\text{F}$  ( $20.5^{\circ}\text{C}$ ) and the least  $7^{\circ}\text{F}$  ( $3.7^{\circ}\text{C}$ ).

This is still a very dry month with a mean of 2.6 rainy days and a mean fall of 1.35 inch (34.3 m. m.).

The total amount for the month has varied during the ten years from *nil* in 1903 and 1906 to 6.18 inches in 1907. The highest fall on any one day was 2.62 inches (66 m.m.) on the 1st of 1907.\*

The mean relative humidity is 62.8 %.

The wind varies from the E. N. E., to N. E., S. S. E., and S., or S. S. W. The last mentioned is the "Lom Wow" or kite flying breeze which during this month begins to blow regularly throughout the day. The occurrence of a tornado during this month has already been referred to under "General considerations."

*April* is the hottest and most unpleasant month of the year. In the shade, the mean is  $87^{\circ}\text{F}$  ( $30.6^{\circ}\text{C}$ ), the mean of maxima  $96.6^{\circ}\text{F}$  ( $35.8^{\circ}\text{C}$ ) and the mean of minima  $76.4^{\circ}\text{F}$  ( $24.6^{\circ}\text{C}$ ). The mean solar radiation figure is  $145^{\circ}\text{F}$  ( $62.7^{\circ}\text{C}$ ) with a maximum for this month of  $159^{\circ}\text{F}$  ( $70.5^{\circ}\text{C}$ ) in the sun in 1910 and a minimum of  $95^{\circ}\text{F}$  ( $35^{\circ}\text{C}$ ) in the sun in 1908.

The extremes in the shade are  $106^{\circ}\text{F}$  ( $41.1^{\circ}\text{C}$ ) on the 7th in 1906 as a maximum and  $68^{\circ}\text{F}$  ( $20^{\circ}\text{C}$ ) as a minimum on the 6th in 1904.

The mean daily range is  $20.1^{\circ}\text{F}$  ( $11.1^{\circ}\text{C}$ ).

Rain falls on an average 5.1 days and the mean amount recorded is 2.03 inches (52 m.m.)

Here again the total fall has varied during the ten years from *nil* in 1903 to 5.71 inches (144.8 m.m.) in 1904. Whether

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\* See footnote to account for May.

showers may be recorded during the earlier part of the month or not, it may be taken as a regular thing that there will be a heavy shower or two from the 18th. to the 21st. after which the climate is oppressive and damp until the rains properly set in.

Hail fell on the 7th. of 1904, an incident which is said to take place once in ten years in Bangkok. On this day, there was nothing else unusual, the solar radiation being  $148^{\circ}$  F, the shade maximum  $96^{\circ}$  F and the mean for the day  $84.8^{\circ}$  F. As just mentioned above, this was our wettest April. The relative humidity was 62.2% in 1911.

The prevailing wind begins to change from the N. E. \* to the S. W.

*May* is the month when the South West Monsoon sets in properly in Bangkok and the rains break. In the general survey of the climate, it has been shown that in nine out of the ten years, the rains set in somewhere between the 2nd. and 11th of the month.

The mean rainfall is 8.13 inches (206.5 m.m.) while the greatest amount for the month was 12.5 inches (318 m.m.) in 1904, and the least 3.15 inches (80 m.m.) in 1902. The average number of rainy days is 16.9.

The greatest rainfall recorded during any one day during these ten years was 4.5 inch (114.3 m.m.) on the 8th May 1903.\*

The shade temperatures are as follows:—mean  $85.9^{\circ}$  F ( $30^{\circ}$  C), mean of maxima  $94.7^{\circ}$  F ( $34.8^{\circ}$  C), mean of minima  $76.1^{\circ}$  F ( $24.4^{\circ}$  C), mean daily range  $18.5^{\circ}$  F ( $10.3^{\circ}$  C), greatest daily range  $30^{\circ}$  F ( $16.6^{\circ}$  C) and least daily range  $5^{\circ}$  F ( $2.7^{\circ}$  C). The extremes range from  $106^{\circ}$  F ( $41.1^{\circ}$  C) on the 7th. of 1906 to  $72^{\circ}$  F ( $22.2^{\circ}$  C) on the 8th. of 1903 and the 4th, 14th and 26th. of 1904.

The mean maximum solar temperature is  $145^{\circ}$  F ( $62.7^{\circ}$  C) with a maximum of  $161^{\circ}$  F ( $71.6^{\circ}$  C) in 1910 and a minimum in the sun of  $82^{\circ}$  F ( $27.8^{\circ}$  C) on the 14th. of 1903, the lowest figure recorded in the sun during the ten years.

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\* Since writing the above, the maximum rainfall on any one day has been exceeded by 0.7 inch. On the morning of the 31st March 1912, strong winds set in about 4 a. m. and were accompanied by heavy rain which started at about 4.45 a. m. and continued almost without intermission until 10 a. m. during which period a fall of 5.35 inches (135.9 m.m.) was recorded

The prevailing winds are from the S. W. and S. and are gentle breezes as a rule, but every heavy shower, during this month, is usually preceded by strong winds which mark the month as one of squalls.

*June.* After the burst of the monsoon in May, the rains slacken off somewhat during June although the average number of rainy days is 17.4 just over that of the previous month.

The mean rainfall is 5.9 inches (149.9 m.m.), with a total of 10.18 inches (257 m.m) in June 1910 falling to a total of 2.99 inches (76 m.m) in 1902.

The greatest amount in any one day was 1.7 inch (43.2 m.m.) on the 2nd. of 1903.

The mean shade temperatures are :—

Mean 84.8° F (29.3° C), mean of maxima 92.6° F (33.6° C), mean of minima 76° F (24.4° C), mean daily range 16.5° F (9.1° C), greatest daily range 25° F (13.8° C) and least daily range 6° F (3.3° C).

The extreme shade temperatures were 100° F (37.8° C) on the 1st and 2nd of 1902, and the 20th of 1903, as maxima, and 70° F (21.1° C) as a minimum on the 10th of 1909.

The mean sun temperature is 143° F (61.5° C) with a maximum of 161° F (71.6° C) in 1911 and a minimum of 103° F (39.4° C) in 1903.

The average relative humidity is 69.4.°/.

The wind remains steady from the S. W. though it occasionally veers to the W. or S.

*July.* Temperatures and rainfall show little variation from those of June.

The means in the shade are as follows :—absolute mean 84.4° F (29.2° C), mean of maxima 92.3° F (33.5° C), mean of minima 75.7° F (24.3° C) and mean daily range 16.6° F (9.2° C).

The extremes in the shade were a maximum of 101° F (38.3° C) on the 7th and 8th., 1908, a minimum of 71° F (21.7° C)

on the 12th 1908, and on the 8th, 1911, a maximum daily range of 25° F (13.8° C) on the 7th and 8th 1908, and on the 30th. 1910, and a minimum daily range of 8° F (4.4° C) on the 3rd, 1910.

The mean temperature of solar radiation for this month is 142° F (61.1° C), the highest in the sun being 161° F (71.6° C), in 1910 and in 1911 and the lowest 95° F (35° C) in 1907

The mean rainfall is 5.43 inches (138 m.m) with a mean of rainy days of 17.2.

The highest rainfall recorded on any day was 1.9 inch (48.3 m.m) on the 25th of 1906.

The relative humidity for the month is 67.6 per cent.

The winds continue from the S. W.

*August.* Shows a distinct increase in rainfall, the mean being 7.45 inches (189.2 m.m.) with 18.6 as the average number of rainy days.

During the ten years, the rainfall has varied as much as from 2.8 inches (71.1 m.m.) in 1904 to 12.65 inches (321.3 m.m.) in 1910.

The greatest fall on any one day was 2.24 inches (57. m.m.) on the 28th of 1910. The relative humidity is 65.9 per cent.

The shade temperatures are:—mean 84.1° F (28.9° C), mean of maxima 92.1° F (33.8° C), mean of minima 75.5° F (24.2° C), mean daily range 16.5° F (9.1° C), the highest recorded being 99° F (37.2° C) on the 10th, 1906, the lowest 72° F (22.2° C) on the 9th, 1911, the greatest daily range being 24° F, (13.3° C) in 1906 and the least daily range being 6° F (3.3° C) in 1908.

In the sun, the mean is 141° F, (60.5° C) the highest being 169° F (76.1° C) on the 1st of 1911 which is the highest record in the sun during the ten years.

The lowest sun temperature for this month was 97° F (36.1° C) in 1908.

The breezes are still like those of July from the S. W.

*September* has been uniformly throughout these ten years the wettest month, the mean being 13.65 inches (346.7 m.m.). The

range has varied between 6.3 inches ( 160 m.m. in 1907 and 16.64 inches ( 422.4 m.m. ) in 1902.

The mean of rainy days is 21.6 and the relative humidity 73.1 per cent. The greatest fall on one day was 3.7 inches ( 94 m.m. ) on the 15th of 1909.

As for the temperature, the means in the shade are as follows:—absolute mean  $83.2^{\circ}\text{F}$  ( $28.4^{\circ}\text{C}$ ), mean of maxima  $90.9^{\circ}\text{F}$  ( $32.8^{\circ}\text{C}$ ), mean of minima  $75.3^{\circ}\text{F}$  ( $24.1^{\circ}\text{C}$ ) and the mean daily range  $15.4^{\circ}\text{F}$  ( $8.5^{\circ}\text{C}$ ). The extremes in the shade were:—highest  $98^{\circ}\text{F}$  ( $36.7^{\circ}\text{C}$ ) on the 7th. of 1906, lowest  $70^{\circ}\text{F}$  ( $21.1^{\circ}\text{C}$ ) on the 26th. of 1902, greatest daily range  $24^{\circ}\text{F}$  ( $13.3^{\circ}\text{C}$ ) on the 17th. of 1908, and the least daily range  $6^{\circ}\text{F}$  ( $3.3^{\circ}\text{C}$ ) on the 22nd. of 1908.

The temperature of solar radiation is  $141^{\circ}\text{F}$  ( $60.5^{\circ}\text{C}$ ) as a mean, while the maximum recorded was  $161^{\circ}\text{F}$  ( $71.6^{\circ}\text{C}$ ) in 1911, and the minimum in the sun was  $90^{\circ}\text{F}$  ( $32.2^{\circ}\text{C}$ ) in 1908.

The breezes nearly all come from the W. S. W., N. W., and S.

*October.* The rains are now lessening and in fact, although November may occasionally show a considerable rainfall, this month ends the real rainy season. The average fall for the ten years is 9.04 inches ( 229.5 m.m ) with a mean number of rainy days of 18.7, and a relative humidity of 74.1 per cent.

The highest rainfall on one day was 2.75 inches ( 69.8 m.m ) on the 7th. of 1911.

Throughout the ten years, the total rainfall for the month has varied from 4.58 inches ( 123.2 m.m. ) in 1906 to 13.41 inches ( 340.4 m.m. ) in 1911.

The temperatures are generally slightly less than during the preceding month although the climate is still muggy and damp.

The shade temperatures are as follows:—mean  $82.7^{\circ}\text{F}$  ( $28.2^{\circ}\text{C}$ ), mean of maxima  $90.8^{\circ}\text{F}$  ( $32.7^{\circ}\text{C}$ ), mean of minima  $74.8^{\circ}\text{F}$  ( $23.8^{\circ}\text{C}$ ), mean daily range  $16.1^{\circ}\text{F}$  ( $8.9^{\circ}\text{C}$ ), highest recorded  $100^{\circ}\text{F}$  ( $37.8^{\circ}\text{C}$ ) on the 30th. of 1906, lowest recorded  $64^{\circ}\text{F}$  ( $17.8^{\circ}\text{C}$ ) on the 23rd. of 1906, the greatest daily range  $27^{\circ}\text{F}$  ( $15^{\circ}\text{C}$ ) on the 23rd. of 1906 and the least daily range being  $5^{\circ}\text{F}$  ( $2.7^{\circ}\text{C}$ ) on the 2nd. of 1903.

The mean temperature of solar radiation is  $139^{\circ}\text{F}$ , ( $59.4^{\circ}\text{C}$ ) the maximum being  $163^{\circ}\text{F}$  ( $72.7^{\circ}\text{C}$ ) in 1910 and the minimum in the sun being  $86^{\circ}\text{F}$ . ( $30^{\circ}\text{C}$ ) in 1903.

Towards the end of the month, the winds are variable and may blow from the N. N. W., E. S. E., or W. until the N. E. monsoon is established.

*November.* The North-East monsoon sets in during this month. If early, the month is a very pleasant one with bright clear skies, cool nights and still cooler mornings. In Bangkok, however, the break of the monsoon may be delayed till the end of this month, the wind occasionally blowing from the S. W. and making it, therefore, a very hot and unpleasant period.

A few showers of rain still tend to fall during the early part of the month, the mean fall being 2.84 inches (72.4 m.m.) and the mean number of rainy days being 5.8. The highest record on one day was 2.75 inches (69.8 m.m.) on the 4th of 1905. During the ten years under review, the rainfall for this month has varied from 0.4 inch (10.2 m.m.) in 1903 to as much as 8.14 inch (207 m.m) in 1909.

It is well, however, to have all water tanks filled up by the end of October.

The temperature records show an improvement during this month, the mean shade reading being  $80.4^{\circ}\text{F}$  ( $26.9^{\circ}\text{C}$ ). The other shade temperatures are as follows:—mean of maxima  $89.3^{\circ}\text{F}$  ( $31.8^{\circ}\text{C}$ ), mean of minima  $71.3^{\circ}\text{F}$  ( $21.8^{\circ}\text{C}$ ), the mean daily range  $18.5^{\circ}\text{F}$  ( $10.3^{\circ}\text{C}$ ), the highest reading being  $99^{\circ}\text{F}$  ( $37.2^{\circ}\text{C}$ ) in 1907 and the lowest  $56^{\circ}\text{F}$  ( $13.3^{\circ}\text{C}$ ) in 1906, the greatest daily range  $31^{\circ}\text{F}$  ( $17.2^{\circ}\text{C}$ ) on the 18th November 1906, and the least daily range  $6^{\circ}\text{F}$  ( $3.3^{\circ}\text{C}$ ) on the 28th of 1909.

In the sun, the mean maximum is  $138^{\circ}\text{F}$  ( $58.8^{\circ}\text{C}$ ) with an actual maximum of  $160^{\circ}\text{F}$  ( $71.1^{\circ}\text{C}$ ) in 1909 and an actual minimum of  $100^{\circ}\text{F}$  ( $37.8^{\circ}\text{C}$ ) in 1903.

The relative humidity is 68.2 per cent.

*December* is the coolest month of the year, showing a mean temperature of 78° F (25.6° C) in the shade. The other shade readings are these—mean of maxima 88.9° F (31.6° C), mean of minima 66.8° F (19.3° C), mean daily range 22.1° F (12.2° C), highest recorded being 100° F (37.8° C) in 1906 and the lowest being 52° F (11.1° C) the actual lowest record during these ten years. This was on the 21st. December 1907, and was followed on the 22nd. and 23rd. of the same month by readings of 53° F (11.7° C) and 56° F (13.3° C) respectively.

A minimum of 53° F was again registered on the 26th of 1910. The extremes of daily range vary from 33° F (18.3° C) in 1906 to 6° F (3.3° C) in 1904.

The maxima in the sun give a mean of 137° F (58.3° C) and a range between 157° F (70° C) and 90° F (32.2° C). The mean rainfall is only 0.37 inches (9.5 m.m.) with a mean of 1.7 rainy days and a relative humidity of 66.7 per cent. The greatest rainfall on one day was measured on the 15th of 1903 and amounted to 0.92 inch (23.4 m.m.).

Although the N. E. monsoon prevails, yet the wind is often from the E., S. S. E., and S. and sometimes as far round as the S. S. W. when the clear dry weather typical of this month gives place to cloudy and warm weather accompanied by a few showers

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APPENDICES.

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## APPENDIX I.

Mean and Extreme Temperature in shade in Bangkok during 10 years, 1902-1911.

MONTH.	MEANS										EXTREMES							
	Mean.		Mean of				Greatest Daily Range.		Least Daily Range.		Highest Maximum		Lowest Minimum					
			Maxima.		Minima.						Degrees		Degrees					
	F.	C.	F.	C.	F.	C.	F.	C.	F.	C.	Year	Degrees	Year	Degrees				
															F.	C.	F.	C.
Jan.	79.0	26.1	92.1	33.3	66.7	19.3	25.4	14.1	40	22.2	14	7.7	1906-07	100	37.8	1907	54	12.6
Feb.	81.2	27.3	93.0	33.9	70.2	21.2	22.7	12.6	41	22.7	3	1.6	1906	106	41.1	1902	56	13.3
March	84.7	29.3	94.7	34.8	73.3	23.0	20.6	11.4	37	20.5	7	3.7	1903	103	39.4	1908	62	16.7
April	87.0	30.6	96.6	35.8	76.4	24.6	20.1	11.1	32	17.7	8	4.4	1906	106	41.1	1904	68	20.0
May	85.9	30.0	94.7	34.8	76.1	24.4	18.5	10.3	30	16.6	5	2.7	1906	106	41.1	1903-04	72	22.2
June	84.8	29.3	92.6	33.6	76.0	24.4	16.5	9.1	25	13.8	6	3.3	1902-03	100	37.8	1909	70	21.1
July	84.4	29.2	92.3	33.5	75.7	24.3	16.6	9.2	25	13.8	8	4.4	1908	101	38.3	1908-11	71	21.7
Aug.	84.1	28.9	92.1	33.3	75.5	24.2	16.5	9.1	24	13.3	6	3.3	1906	99	37.2	1911	72	22.2
Sept.	83.2	28.4	90.9	32.8	75.3	24.1	15.4	8.5	24	13.3	6	3.3	1906	98	36.7	1902	70	21.1
Oct.	82.7	28.2	90.8	32.7	74.8	23.8	16.1	8.9	27	15.0	5	2.7	1906	100	37.3	1906	64	17.8
Nov.	80.4	26.9	89.3	31.8	71.3	21.8	18.5	10.3	31	17.2	6	3.3	1907	99	37.2	1906	56	13.3
Dec.	78.0	25.6	88.9	31.6	66.8	19.3	22.1	12.2	33	13.3	6	3.3	1906	100	37.8	1907	52	11.1

Mean temperature in shade for 10 years 82.98 F or 28.3 C.

## APPENDIX II.

Mean and extreme Rainfall in Bangkok during 10 years, 1902 to 1911.

MONTH.	MEANS			EXTREMES.		
	Rainfall during month in		Number of days on which rain fell.	Greatest rainfall in 24 hours.		Date.
	Inches	Millimetres		Inches.	Millimetres	
January	0.25	6.4	1.5	0.98	25.0	24th of 1910
February	0.67	17.0	2.0	2.47	62.8	25th " 1910
March	1.35	34.3	2.6	2.62	66.5	1st " 1907
April	2.03	52.0	5.1	2.13	54.0	18th " 1904
May	8.13	206.5	16.9	4.5	114.3	8th " 1903
June	5.90	149.9	17.4	1.7	43.2	2nd " 1903
July	5.43	138.0	17.2	1.9	48.3	25th " 1906
August	7.45	189.2	18.6	2.24	57.0	28th " 1910
September	13.65	346.7	21.6	3.7	94.0	15th " 1909
October	9.04	229.5	18.7	2.75	69.8	7th " 1911
November	2.84	72.4	5.8	2.75	69.8	4th " 1905
December	0.37	9.5	1.7	0.92	23.4	15th " 1903

Mean Rainfall for 10 years = 57.14 inches or 1451.5 millimetres.

## APPENDIX III.

A Comparison of Dr. Campbell's and Dr. Hightet's figures for 10 years,  
1858-1868 (circa) and 1902-1911.

MONTH.	TEMPERATURE IN SHADE (FAHRENHEIT SCALE).										Rainfall in inches.		Number of rainy days.	
	Mean.		Mean of Maxima		Mean of Minima.		Mean Daily Range.							
	C.*	H.*	C.	H.	C.	H.	C.	H.	C.	H.	C.	H.		
January	76.1	79.0	87.7	92.1	69.4	66.7	...	25.4	0.9	0.25	2	1.5		
February	79.1	81.2	88.6	93.0	74.1	70.2	...	22.7	0.56	0.67	7	2.		
March...	82.5	84.7	93.0	94.7	74.5	73.3	...	20.6	0.83	1.35	1	2.6		
April ...	83.4	87.0	94.1	96.6	79.0	76.4	...	20.1	2.42	2.03	10	5.1		
May ...	82.3	85.9	89.7	94.7	76.8	76.1	...	18.5	10.54	8.13	20	16.9		
June ...	82.3	84.8	89.4	92.6	78.1	76.0	...	16.5	7.72	5.90	16	17.4		
July ...	81.4	84.4	88.1	92.3	76.3	75.7	...	16.6	8.02	5.43	26	17.2		
August	81.4	84.1	89.0	92.1	76.2	75.5	...	16.5	5.65	7.45	17	18.6		
September	80.3	83.2	88.6	90.9	76.7	75.3	...	15.4	11.30	13.65	22	21.6		
October	80.1	82.7	87.3	90.8	75.1	74.8	...	16.1	7.46	9.04	14	18.7		
November	76.8	80.4	83.7	89.3	70.3	71.3	...	18.5	2.36	2.84	6	5.8		
December	74.8	78.0	81.6	88.9	63.3	66.8	..	22.1	0.09	0.37	2	1.7		
	80.1	82.9	—	—	—	—	...	—	67.04	57.14	143	129.1		

\* C.=Dr. Campbell's figures; H.=Dr. Hightet's figures.

## APPENDIX IV.

Mean Temperatures for the Month.

Year.	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Mean for Year.
1902	77.1	77.0	84.8	86.1	85.8	86.5	84.9	84.1	82.4	82.7	81.4	81.2	82.83
1903	80.6	80.7	87.0	88.6	87.1	83.2	84.0	82.7	81.7	81.5	78.4	72.4	82.32
1904	73.9	78.3	83.9	84.7	85.4	84.7	84.2	84.4	83.6	83.3	79.6	76.3	81.86
1905	81.4	84.8	86.0	88.8	85.8	84.8	84.8	85.4	83.9	83.7	82.2	85.2	84.73
1906	83.6	85.5	86.4	90.3	88.6	86.1	85.3	85.1	84.7	82.5	79.5	79.2	84.72
1907	78.7	82.5	83.2	86.2	84.7	84.3	84.2	83.1	83.3	82.5	81.3	74.8	82.49
1908	78.6	81.3	84.0	86.6	85.3	84.7	84.3	83.4	83.2	82.9	78.3	78.2	82.56
1909	79.0	82.3	84.4	86.2	85.0	84.9	83.8	84.1	83.4	83.3	79.0	76.1	82.60
1910	80.4	80.0	82.9	86.1	85.3	84.1	84.6	84.1	82.0	82.2	80.7	75.4	82.30
1911	77.5	80.4	84.4	87.1	86.0	84.8	84.5	85.0	83.9	83.3	84.3	81.4	83.55
Mean for 10 years.	79.0	81.28	84.70	87.07	85.90	84.81	84.46	84.14	83.21	82.79	80.47	78.02	82.98

## APPENDIX V.

Mean of Maxima for the Month.

Year.	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1902	89.7	87.7	93.0	94.5	94.3	95.5	92.7	92.2	90.5	90.0	89.7	90.8
1903	91.1	92.0	97.4	99.0	97.5	90.8	92.4	90.6	88.2	88.0	86.0	82.2
1904	87.9	92.3	93.2	93.8	93.4	90.2	90.2	90.8	90.4	90.9	88.1	87.3
1905	93.1	94.0	94.0	97.5	93.2	90.6	91.4	92.3	90.5	89.7	89.9	93.4
1906	95.1	97.6	96.6	100.6	97.1	94.6	93.6	93.1	92.8	92.0	90.9	93.6
1907	93.1	93.5	94.1	95.4	93.0	92.6	92.7	91.0	92.2	91.5	92.7	87.2
1908	98.6	95.0	95.9	96.0	95.0	93.6	93.7	91.5	91.1	90.9	86.2	88.3
1909	93.0	93.9	95.9	97.3	94.5	94.1	91.7	93.2	91.7	92.9	87.2	87.0
1910	92.6	92.3	93.0	95.9	95.0	92.6	93.9	93.0	90.2	90.9	89.7	86.8
1911	92.1	92.3	94.3	96.5	94.4	92.3	91.6	93.3	91.7	91.2	94.1	93.0
Mean for 10 years.	92.13	93.06	94.74	96.65	94.74	92.69	92.39	92.1	90.93	90.8	89.35	88.96

## APPENDIX VI.

Mean of Minima.

Year.	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1902	65.1	66.4	72.5	76.6	76.8	77.2	76.4	76.3	75.3	75.0	72.6	72.0
1903	69.5	72.0	76.5	79.3	77.3	76.7	77.0	76.4	76.1	75.6	71.4	65.0
1904	64.7	66.9	73.6	74.3	75.0	76.2	75.5	75.5	75.0	74.4	70.4	63.8
1905	67.0	71.1	73.2	77.7	76.7	76.6	76.0	76.1	75.2	75.2	69.2	69.8
1906	70.1	72.2	75.1	77.6	78.0	75.9	76.1	75.3	75.5	72.2	66.7	65.0
1907	64.8	72.1	73.4	76.2	76.7	76.0	75.1	75.5	75.5	75.9	72.4	65.0
1908	65.7	71.0	73.0	77.0	76.0	75.3	75.0	75.3	76.1	75.6	70.6	69.8
1909	68.0	72.2	74.4	75.6	76.3	75.4	75.5	75.3	74.9	75.2	75.0	65.4
1910	69.6	69.8	70.0	75.5	75.6	75.5	75.2	74.9	74.7	74.8	71.9	64.2
1911	63.0	69.2	71.9	75.0	73.3	75.4	75.5	74.8	75.6	74.4	73.2	68.7
Mean for 10 years. }	66.75	70.29	73.36	76.48	76.17	76.02	75.73	75.54	75.39	74.83	71.34	66.82

APPENDIX  
Dates and Amounts of

Year	January	February	March	April	May	June
1902	93 on 17, 18, 19, 31	94 on 1, 2, 17	102 on 23	98 on 28	102 on 31	100 on 1, 2
1903	97 on 26	97 on 25, 27, 28	103 on 31	103.5 on 21	104 on 18	100 on 20
1904	93 on 29, 30	97 on 25	96 on 29	101 on 15, 17	98 on 24, 26	93 on 17
1905	97 on 23	98 on 3, 26	100 on 31	104 on 30	99 on 3	94 on 2, 10
1906	100 on 15, 16, 23, 24, 31	106 on 26	100 on 3, 12, 29	106 on 8, 19	106 on 7	99 on 9, 30
1907	100 on 16	100 on 11	102 on 9, 10	103 on 30	100 on 2	98 on 13
1908	98 on 22, 31	102 on 2, 3, 4	101 on 5	101 on 15, 17	99 on 5	98 on 3, 4, 5
1909	97 on 27	98 on 20, 24, 28	99 on 27	101 on 25	102 on 3	98 on 12, 13
1910	96 on 5, 8, 11, 2	100 on 27, 28	99 on 2	100 on 21, 22	101 on 5, 8, 10, 11	97 on 3
1911	96 on 10	97 on 8, 16	99 on 17	101 on 25	100 on 2	97 on 26

## VII.

## Highest Maxima.

July	August	September	October	November	December
98 on 21, 22	98 on 9, 10	97 on 18	94 on 12	93 on 21	95 on 7, 9, 10
99 on 4, 6, 7	96 on 12	92 on 23	93 on 9	91 on 8, 9	91 on 14
94 on 23, 24	96 on 28	96 on 1	95 on 20, 21, 22	93 on 13	96 on 12
95 on 13, 21	96 on 13	97 on 16	95 on 19	96 on 1, 3	98 on 26
100 on 2	99 on 10	98 on 7	100 on 30	98 on 1, 2	100 on 20
97 on 10	94 on 2, 17, 27, 28, 29	96 on 13, 21, 26, 27	96 on 8, 14, 27	99 on 21	96 on 30, 31
101 on 7, 8	97 on 24	96 on 8, 14	96 on 13	95 on 4	93 on 17, 18, 31
97 on 3	96 on 14, 15	97 on 14	98 on 2	92 on 8, 9	96 on 31
98 on 13, 14, 30	98 on 20	95 on 15	96 on 9	95 on 28, 29	95 on 11
96 on 27	97 on 29	95 on 1, 3	97 on 31	98 on 2	97 on 2

## Dates and Amounts of

Year.	January	February	March	April	May	June
1902	59 on 3	56 on 13, 14	70 on 5	73 on 6, 30	73 on 17	74 on 20
1903	58 on 7	66 on 9	71 on 4	72 on 1	72 on 8	75 on 1, 2, 17, 28
1904	58 on 22	59 on 12	68 on 16	68 on 6	72 on 4, 14, 26	74 on 1
1905	60 on 1	66 on 1	68 on 19	74 on 1, 7, 9, 19	74 on 10, 14, 25	74 on 3, 4, 6
1906	65 on 2, 31	65 on 1, 2	64 on 8	72 on 7, 18	74 on 30, 31	74 on 9, 12, 17, 24, 28
1907	54 on 3, 4, 6, 7	69 on 6, 10	66 on 6	70 on 1, 6	74 on 3, 5, 7, 8, 10, 11, 17	74 on 19
1908	60 on 10	61 on 3	62 on 22	72 on 10	74 on 2, 4, 16 21, 22	72 on 21
1909	61 on 23	66 on 13	68 on 13, 26	73 on 11	74 on 5	70 on 10
1910	58 on 26	59 on 2	68 on 23	73 on 12	71 on 6	73 on 20
1911	58 on 2, 23	58 on 2	66 on 17	70 on 29	73 on 9, 10 *	71 on 24

## VIII.

## Lowest Minima.

July	August	September	October	November	December
73 on 20	74 on 4	70 on 26	73 on 20	68 on 10	69 on 20, 21, 26, 27, 28
72 on 21	74 on 9, 10	71 on 16	71 on 30	64 on 28	58 on 24, 25, 26
74 on 5, 11, 12, 15, 25, 27 30, 31	74 on 16, 19, 22, 25, 27, 28,	72 on 13	74 on 8th to 31st 24 days	62 on 19	56 on 3, 4
74 on 9, 15, 19, 30, 31	74 on 1, 2, 4	74 on 8, 9, 10, 13, 15, 17, 20, 22, 23, 24, 25, 26, 29.	72 on 21, 22	64 on 20, 21	66 on 20, 21
72 on 10	74 on 2, 3, 9, 14, 15, 16, 21, 23, 25, 26, 29	73 on 29	64 on 23	56 on 15	57 on 13
72 on 6	74 on 10, 11, 14, 15, 26, 29	72 on 19	73 on 4, 22, 24	66 on 30	52 on 21
71 on 12	74 on 1, 2, 8, 10, 12, 18, 23, 27, 30	71 on 17	74 on 16, 20, 24, 26, 29, 31	64 on 25, 29, 30	61 on 9, 10
72 on 20	74 on 2, 8, 10, 12, 13, 16	72 on 15, 22	73 on 12, 13, 15	62 on 19	60 on 22, 26
73 on 30	73 on 30	73 on 20, 26, 27	70 on 14	67 on 19	53 on 26
71 on 8	72 on 9	73 on 10	71 on 17	70 on 14	63 on 11, 12

## APPENDIX IX.

Greatest Daily Range per mensem.

Year.	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1902	28	31	24	23	24	24	22	21	22	18	20	24
1903	28	27	31	30	30	25	23	19	17	16	19	23
1904	27	33	26	26	26	17	18	22	22	21	24	29
1905	34	28	29	26	24	18	19	20	21	20	26	30
1906	29	36	30	32	28	25	22	24	23	27	31	33
1907	40	30	30	25	24	22	23	20	23	22	25	30
1908	35	41	37	26	23	22	25	22	24	21	22	25
1909	31	26	31	25	26	24	22	21	22	23	23	26
1910	30	30	28	25	27	23	25	23	21	24	22	30
1911	33	33	33	27	25	22	20	22	20	23	24	27

Date and amount of Highest Daily Range = 41 in February 1908.

## APPENDIX X.

Least Daily Range per mensem.

Year	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1902	20	3	13	15	12	12	9	10	7	10	14	12
1903	17	13	14	16	11	8	9	9	8	5	10	11
1904	17	14	12	8	11	10	10	10	9	9	12	6
1905	18	18	10	13	5	6	12	12	11	8	12	16
1906	19	16	14	16	12	14	12	12	7	10	16	18
1907	14	16	8	14	6	10	12	7	12	7	16	9
1908	17	11	14	10	6	14	12	6	6	10	8	11
1909	15	9	15	17	11	12	12	14	9	10	6	11
1910	15	13	7	17	8	8	8	16	9	11	13	12
1911	25	14	14	15	12	6	10	11	10	11	18	19

Date and amount of least daily range = 3 in February 1902.

## APPENDIX XI.

Mean Daily Range per mensem.

	Jan.	Feb.	March.	April	May	June	July	August	Sept.	Oct.	Nov.	Dec.
1902	25.2	21.2	17.5	17.8	17.3	18.2	16.6	15.9	15.2	15.0	17.1	18.6
1903	21.6	20.1	20.9	19.7	20.1	14.1	15.4	14.2	12.1	12.4	14.6	17.3
1904	23.2	25.4	19.2	19.8	18.5	14.0	14.8	15.2	15.2	16.5	17.7	23.5
1905	26.1	22.8	20.4	19.7	16.5	13.7	15.0	16.2	14.6	14.6	20.7	23.5
1906	24.6	25.4	21.4	23.0	19.3	18.7	17.5	17.8	17.3	19.3	24.1	28.7
1907	28.3	21.3	20.7	19.2	17.5	16.6	17.6	15.4	16.6	17.0	19.3	22.1
1908	27.9	24.0	22.9	18.9	18.5	18.3	18.3	16.1	15.0	15.1	16.2	19.0
1909	25.0	21.5	21.5	21.6	18.0	18.3	16.2	18.0	16.7	17.6	16.7	21.6
1910	23.0	22.3	19.4	20.4	19.6	17.0	18.6	18.0	15.5	16.7	17.8	22.5
1911.	29.4	23.0	22.4	21.4	19.1	16.8	16.0	18.5	16.1	16.8	20.8	24.3
Mean for 10 Years.	25.43	22.70	20.63	20.17	18.54	16.57	16.60	16.53	15.43	16.10	18.50	22.11

## APPENDIX XII.

## Means and Extremes of Maximum Solar Radiation Temperatures

Year	January			February			March			April			May			June		
	Mean	Highest	Lowest	Mean	Highest	Lowest	Mean	Highest	Lowest	Mean	Highest	Lowest	Mean	Highest	Lowest	Mean	Highest	Lowest
1902	137	142	132	137	141	117	142	162	133	140	149	129	144	154	131	143	155	117
1903	140	148	131	136	149	109	140	150	131	141	148	134	145	157	117	132	146	108
1904	129	135	125	133	146	129	144	149	141	145	152	105	149	159	123	146	154	115
1905	144	150	133	143	148	135	144	151	110	147	153	145	144	156	102	145	154	118
1906	140	149	120	143	149	130	143	149	115	147	154	135	140	150	115	142	155	120
1907	137	145	129	134	147	120	137	146	87	143	153	97	140	155	86	137	150	110
1908	133	148	114	137	146	110	141	148	130	139	151	95	141	154	82	144	152	120
1909	137	145	110	135	152	111	141	152	95	145	153	135	147	160	117	152	160	126
1910	144	154	127	145	155	111	148	160	109	152	159	140	152	161	118	149	159	116
1911	144	150	136	143	154	131	150	158	144	153	158	142	153	159	136	148	161	106
Mean Solar Temperature for 10 years.	139			138			143			145			145			143		

in Bangkok during 10 years, 1902-1911.

July			August			September			October			November			December		
Mean	Highest	Lowest	Mean	Highest	Lowest	Mean	Highest	Lowest	Mean	Highest	Lowest	Mean	Highest	Lowest	Mean	Highest	Lowest
143	151	104	139	149	112	148	149	109	140	146	125	139	144	127	138	150	113
136	145	115	133	143	113	131	143	117	130	142	86	127	135	100	125	132	107
140	156	122	145	158	120	146	155	121	146	159	129	141	155	107	137	147	100
145	154	127	147	156	132	140	155	110	133	150	115	136	145	110	143	150	131
137	151	110	140	153	100	137	150	95	136	150	100	133	145	125	135	140	120
132	146	95	133	157	110	134	151	100	133	149	110	138	150	120	129	147	90
142	158	99	138	152	97	135	150	90	132	148	105	131	147	102	136	140	130
148	160	118	151	158	145	149	160	104	152	162	133	145	160	121	141	149	129
149	161	121	153	162	138	145	160	115	147	163	122	146	155	131	143	155	130
148	161	105	153	169	128	151	161	138	150	160	134	151	158	146	147	157	132
142			143			141			139			138			137		

## APPENDIX XIII.

Rainfall for the Month.

Year	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total for Year
1902	0.000	0.400	1.000	2.970	3.150	2.995	2.400	6.865	16.640	7.809	1.490	0.800	46.510
1903	0.050	0.300	0.000	0.000	9.888	9.160	4.165	7.505	11.978	7.585	0.425	1.425	52.481
1904	0.000	0.000	0.873	5.715	12.545	4.020	2.980	2.805	15.260	10.383	5.500	0.100	60.131
1905	0.150	0.000	3.050	2.000	11.675	6.350	7.775	6.600	11.755	6.960	2.800	0.000	59.115
1906	0.025	0.000	0.000	0.075	5.100	5.380	7.930	6.910	14.720	4.580	1.230	0.000	45.950
1907	0.560	0.060	6.180	0.350	10.950	5.150	3.090	2.900	6.300	11.160	2.650	0.020	49.370
1908	0.250	0.900	0.060	2.090	9.570	7.320	8.660	10.340	16.600	11.650	4.360	0.330	72.130
1909	0.160	0.250	0.210	1.470	5.350	3.720	7.560	11.160	13.990	7.290	8.140	0.009	59.300
1910	1.350	2.740	2.030	2.660	5.990	10.130	4.620	12.650	14.640	9.630	1.860	1.020	68.820
1911	0.000	2.045	0.100	2.960	7.140	4.770	5.260	6.760	14.630	13.410	0.500	0.010	57.585
Mean of 10 Years	0.254	0.670	1.350	2.029	8.135	5.899	5.439	7.449	13.651	9.044	2.845	0.370	57.139

Mean Number of days on which Rain fell.

Year.	Jan.	Feb.	March	April	May	June	July	August	Sept.	Oct.	Nov.	Dec.
1902	0	1	1	6	14	12	11	20	20	19	4	1
1903	1	4	0	0	11	17	16	16	25	22	1	4
1904	0	0	2	11 Half on 7th	18	18	11	13	21	15	9	1
1905	2	0	2	2	18	16	17	16	20	15	2	0
1906	2	0	0	1	15	15	22	16	23	9	6	0
1907	3	1	6	4	16	18	19	16	21	20	6	1
1908	1	3	1	9	22	20	18	22	22	28	10	4
1909	2	2	3	6	23	20	22	26	17	19	11	0
1910	4	5	10	5	19	21	15	22	24	22	5	5
1911	0	4	1	7	18	17	21	19	23	18	4	1
Mean for 10 Years	1.5	2.0	2.6	5.1	16.9	17.4	17.2	18.6	21.6	18.7	5.8	1.7

## APPENDIX

Date and Amount of Greatest

Year	January	February	March	April	May	June
1902 {	0	0.4 on 4	1.0 on 12	1.2 on 6, 18	0.85 on 21	0.95 on 4
1903 {	0.05 on 16	0.17 on 1	0 0	0 0	4.5 on 8	1.7 on 2
1904 {	0 0	0 0	0.65 on 31	2.130 on 18	2.7 on 7	0.875 on 20
1905 {	0.125 on 13	0 0	2.2 on 6	1.95 on 7	2.925 on 19	1.1 on 9
1906 {	0.025 on 27	0 0	0 0	0.075 on 23	1.8 on 10	1.34 on 4
1907 {	0.43 on 31	0.06 on 21	2.62 on 1	0.30 on 5	2.78 on 3	1.07 on 4
1908 {	0.25 on 29	0.62 on 16	0.06 on 20	0.98 on 21	3.82 on 28	1.55 on 7
1909 {	0.14 on 10	0.24 on 12	0.17 on 10	0.73 on 2	1.25 on 13	0.9 on 24
1910 {	0.98 on 24	2.47 on 25	0.77 on 15	0.73 on 9	1.83 on 11	1.68 on 21
1911 {	0 0	1.65 on 21	0.10 on 31	1.65 on 6	1.86 on 17	1.18 on 3

## XIV.

Rainfall in 24 hours,

July	August	September	October	November	December
0.6 on 31	1.8 on 17	2.68 on 30	1.46 on 17	1.13 on 16	0.8 on 7
0.925 on 16	1.475 on 10	1.7 on 29	0.8 on 11, 29	0.425 on 10	0.92 on 15
1.225 on 11	1.125 on 14	2.750 on 9	1.925 on 17	2.625 on 3	0.1 on 26
1.725 on 18	1.6 on 5	1.55 on 8	1.48 on 20	2.75 on 4	0 0
1.97 on 25	1.13 on 23	3.61 on 29	1.45 on 5	0.76 on 3	0 0
0.68 on 10	0.79 on 3	0.84 on 11	1.78 on 18	1.15 on 1	0.02 on 27
1.83 on 30	1.71 on 27	2.40 on 9	1.7 on 1	1.3 on 8	0.31 on 19
1.8 on 4	1.57 on 16	3.7 on 15	0.87 on 28	3.7 on 6	0 0
1.26 on 5	2.24 on 28	2.27 on 8	2.07 on 5	1.06 on 8	0.58 on 1
1.19 on 3	1.65 on 30	3.03 on 23	2.75 on 7	0.23 on 3	0.01 on 20

## APPENDIX XV.

Relative Humidity of the Atmosphere.

Month	Percentage amount.
January	68.
February	60.4
March	62.8
April	62.2
May	65.5
June	69.4
July	67.6
August	65.9
September	73.1
October	74.1
November	68.2
December	66.7

## APPENDIX XVI.

Bangkok Rainfall for 10 Years 1882-1891. Registered at B. C. L., Koh Kwai.

Year	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Totals.	Average.
1882	.50	...	.21	4.52	5.92	3.78	8.43	3.07	14.15	11.56	1.50	...	53.64	47.92 for 2 years.
1883	...	.63	...	3.6	7.44	9.69	2.10	5.76	8.57	8.44	1.52	...	42.21	43.20 " 3 "
1884	1st Jan to 30th June.	Total	...	...	...	7. -	5.29	3.57	6.18	8.49	3.23	...	33.76	47.37 " 4 "
1885	.10	3.62	.12	1.35	1.52	8.88	6.78	10.96	14.12	9.06	3.35	...	59.86	51.05 " 5 "
1886	...	.52	.95	.72	7.73	8.49	10.97	4.02	16.41	12.85	3.12	...	65.77	51.73 " 6 "
1887	1.79	2.25	.87	2.39	8.76	4.19	7.97	8.75	9.61	6.98	1.56	...	55.12	50.91 " 7 "
1888	...	...	...	1.50	13.25	1.40	4.05	6.39	11.34	6.58	1.50	...	46.01	53.30 " 8 "
1889	5.10	...	1.15	1.04	6.97	5.81	3.88	10.64	16.07	11.14	6.76	1.51	71.07	52.83 " 9 "
1890	.50	.50	...	1.40	8.52	5.68	4.01	12.14	10.26	5. -	.89	...	48.90	51.27 " 10 "
1891	...	5.80	1.62	.46	1.33	1.77	4.54	5.29	7.10	6.93	2.53	...	37.37	
Monthly Averages	88	1.48	.55	1.83	6.83	5.52	5.80	7.06	11.38	8.20	2.59	.15		

for 9 years.

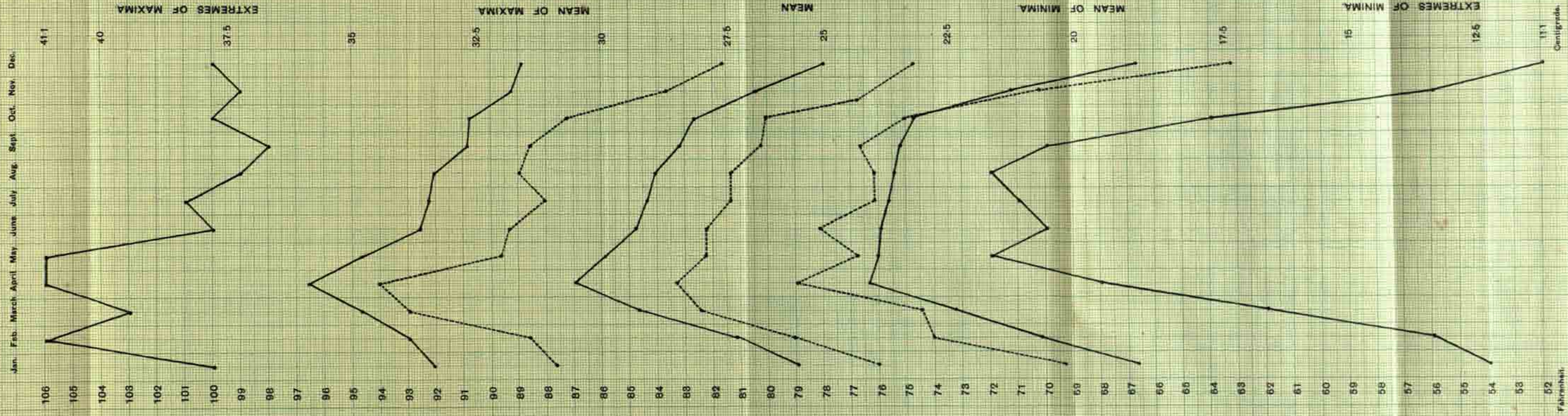
for 10 years.

Note:—The above data, as well as the figures on the following page, have been kindly supplied by the Borneo Co., Ltd., from readings taken in the Company's compound in Bangkok.

APPENDIX XVII.  
SUMMARY—Rainfall Registered at B. C. L., Koh Kwai.

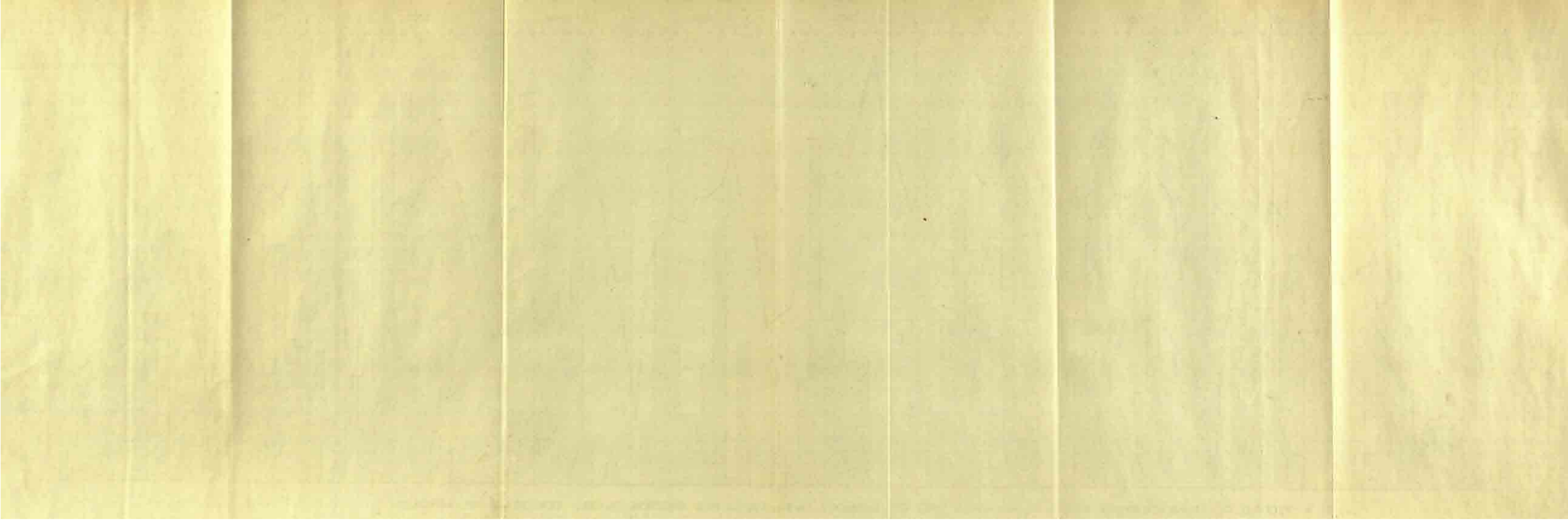
	1902	1903	1904	1905	1906	1907	1908	1909	1910	1911
January	...	...	...	...	.32	.24	...	.08	1.46	...
February	.60	.35	...	...	.27	.48	.30	1.19	3.26	1.42
March	2.88	...	1.37	1.92	...	5.06	.02	.67	.49	...
April	2.94	...	7.69	1.48	.94	1.75	3.18	1.59	.99	3.71
May	2.10	10.13	10.41	16.50	6.53	12.42	10.29	5.87	7.68	7.21
June	2.96	9.59	3.76	4.95	4.61	4.81	9.61	3.49	11.39	4.94
July	3.17	4.01	3.77	6.68	7.46	3.85	9.07	8.07	5.50	2.13
August	5.79	8.09	2.93	7.30	7.01	4.12	10.23	10.42	11.49	6.26
September	18.68	12.48	10.07	13.98	10.70	7.05	16.43	11.86	13.60	13.02
October	10.18	8.66	9.84	7.70	4.84	9.44	13.21	8.63	10.45	9.64
November	1.08	1.38	6.45	3.07	1.27	2.39	4.48	7.93	.74	.45
December	.85	1.42	...	.25	...	.18	.60	...	.85	...
Total	51.23	56.11	56.29	63.83	43.95	51.79	77.42	59.79	67.90	48.78
Average	...	53.67	54.54	56.87	54.28	53.87	57.28	57.55	58.70	57.71

# CHART I.

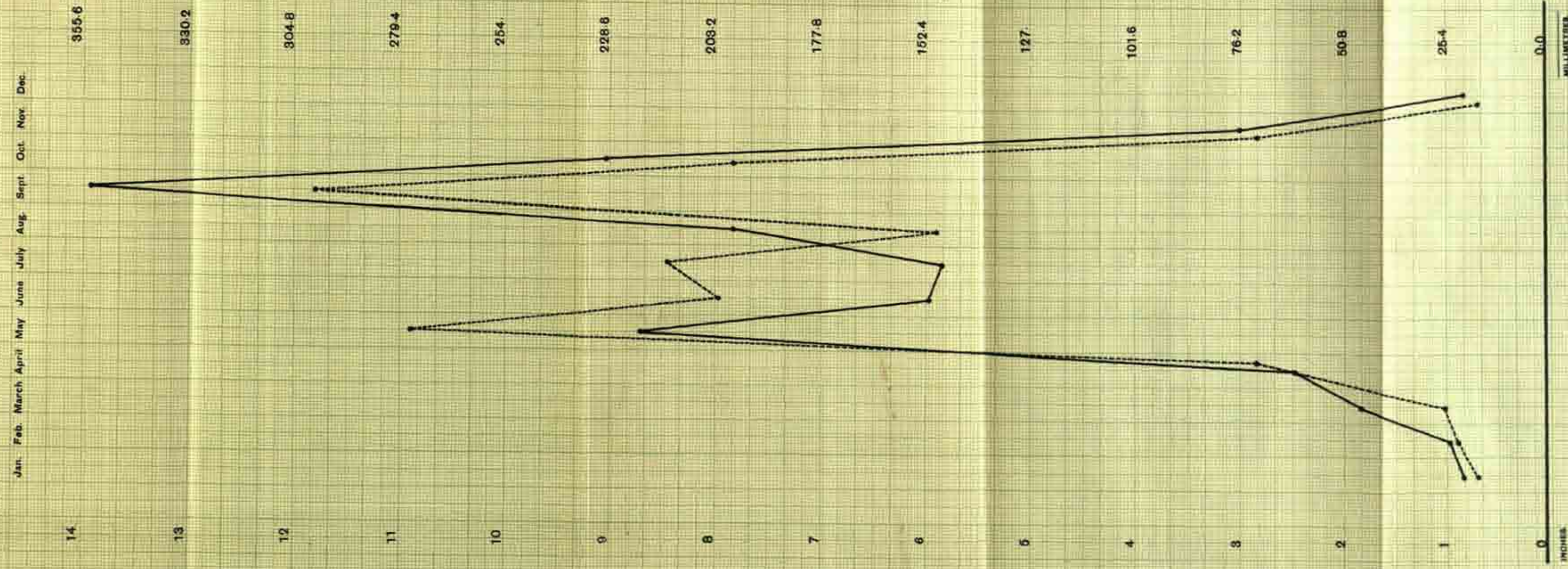


MEAN AND EXTREME TEMPERATURE IN SHADE  
IN BANGKOK DURING TEN YEARS

Firm lines give Dr. Higley's figures, 1902-11  
Dotted lines give Dr. Campbell's figures, 1858-1868, circa

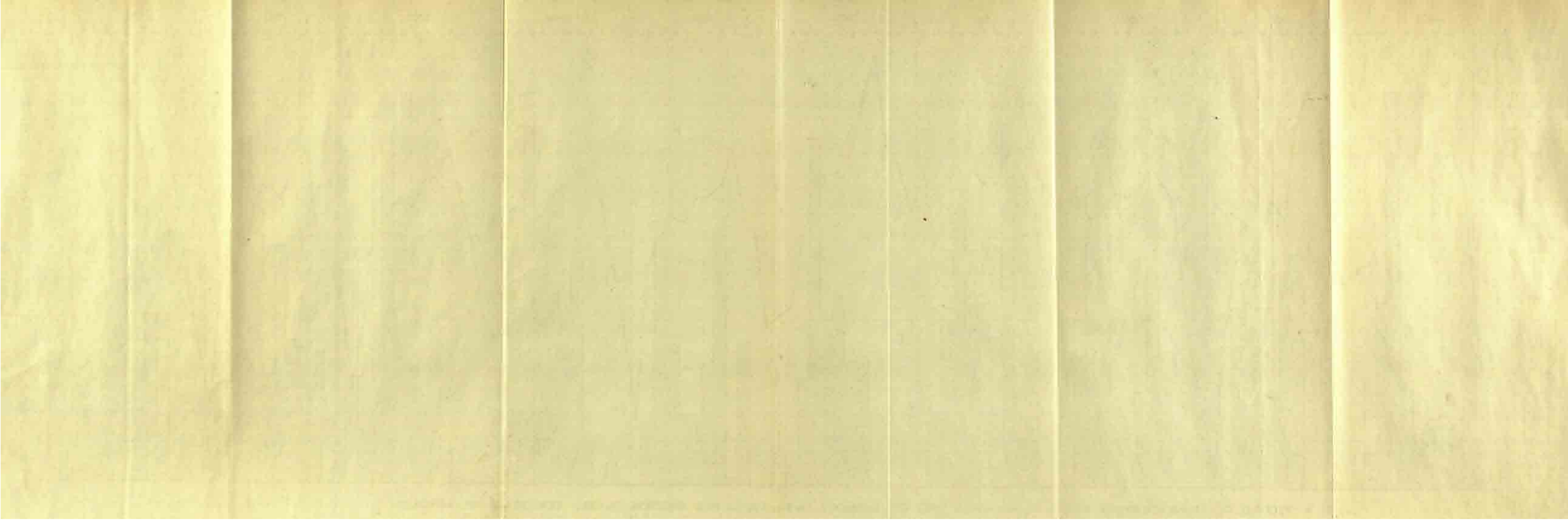


# CHART II.



MEAN RAINFALL IN BANGKOK DURING TEN YEARS.

Firm lines give Dr. Hight's figures, 1902-11.  
Dotted lines give Dr. Campbell's figures, 1858-1868; circa.



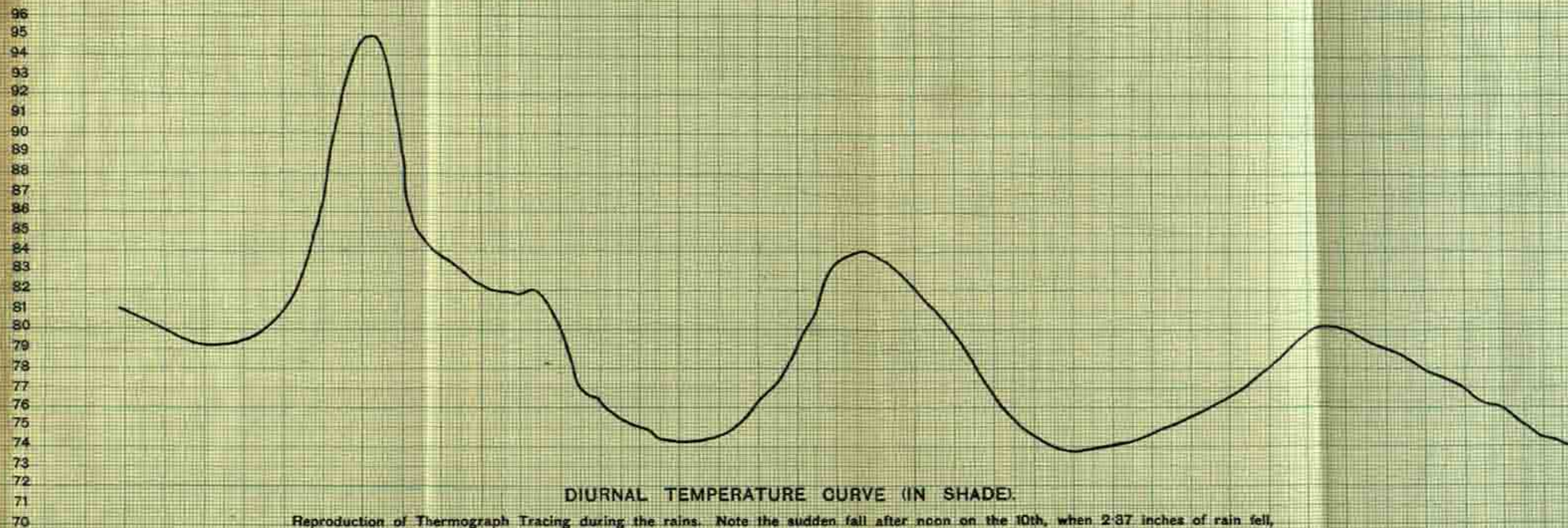
# CHART IV.

10th MAY, 1907.

11th MAY, 1907.

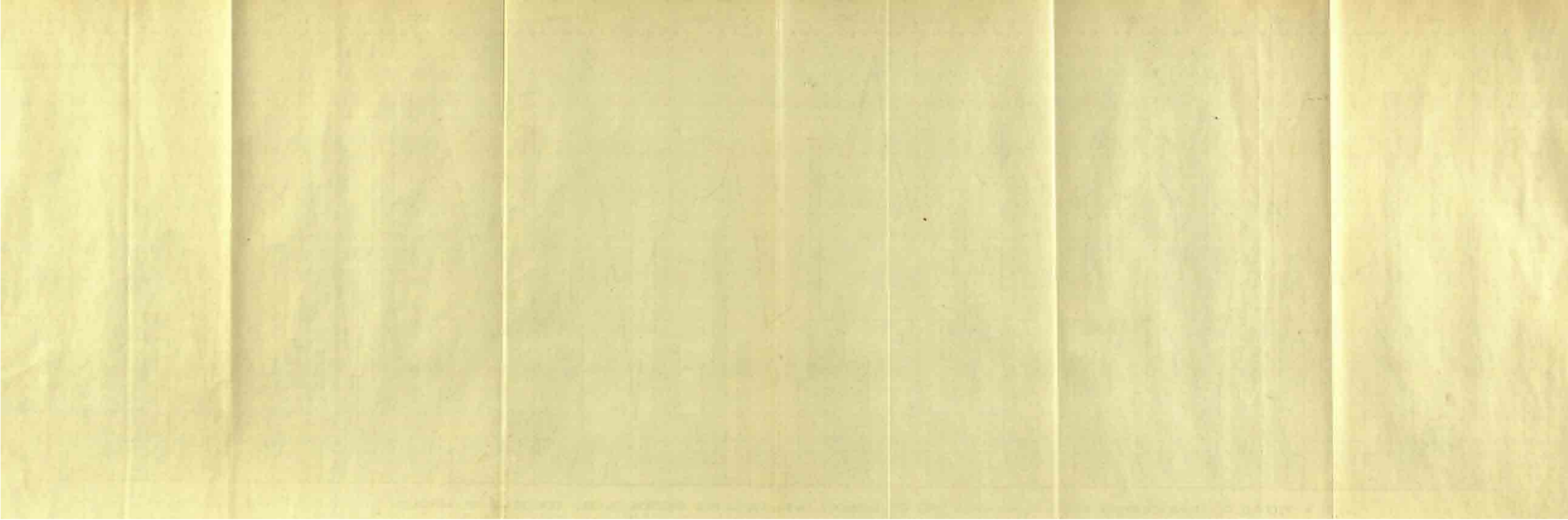
12th MAY, 1907.

MID-NIGHT 2 4 6 8 10 NOON 2 4 6 8 10 MID-NIGHT 2 4 6 8 10 NOON 2 4 6 8 10 MID-NIGHT 2 4 6 8 10 NOON 2 4 6 8 10 MID-NIGHT



DIURNAL TEMPERATURE CURVE (IN SHADE).

Reproduction of Thermograph Tracing during the rains. Note the sudden fall after noon on the 10th, when 2.87 inches of rain fell, and the lessened range during 11th and 12th, when 0.21 and 1.1 inch of rain fell respectively.

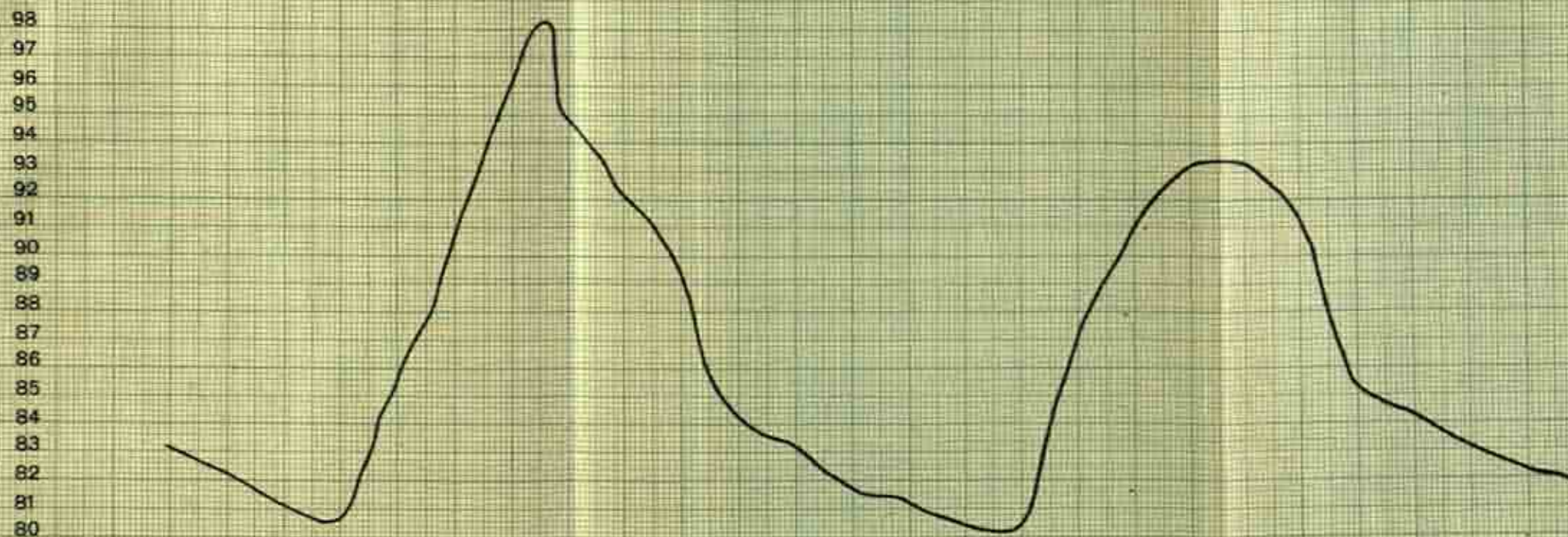


# CHART III.

28TH FEBRUARY, 1907.

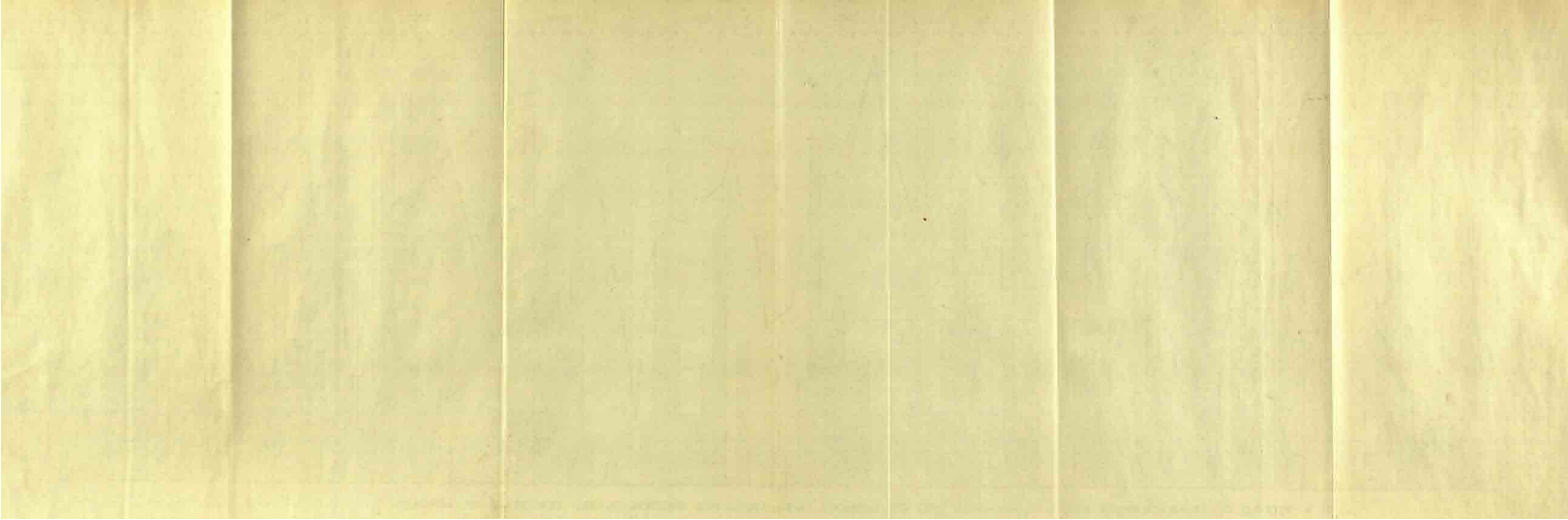
1ST MARCH, 1907.

MID-NIGHT 2 4 6 8 10 NOON 2 4 6 8 10 MID-NIGHT 2 4 6 8 10 MID-NIGHT



DIURNAL TEMPERATURE CURVE (IN SHADE).

Reproduction of a Thermograph Tracing, showing two typical hot, dry days



N. C.  
1922

*"A book that is shut is but a block"*

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